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Preoperative Calm and *Postoperative* Comfort

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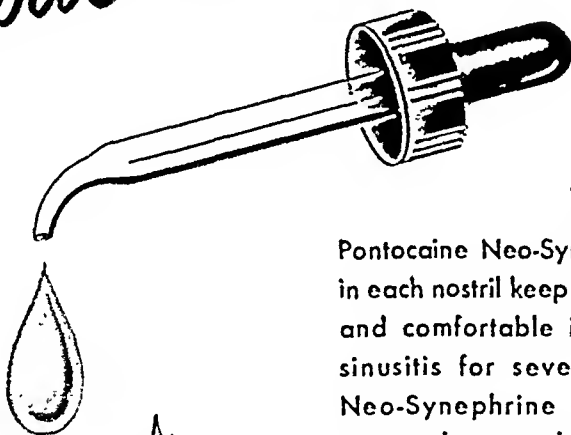
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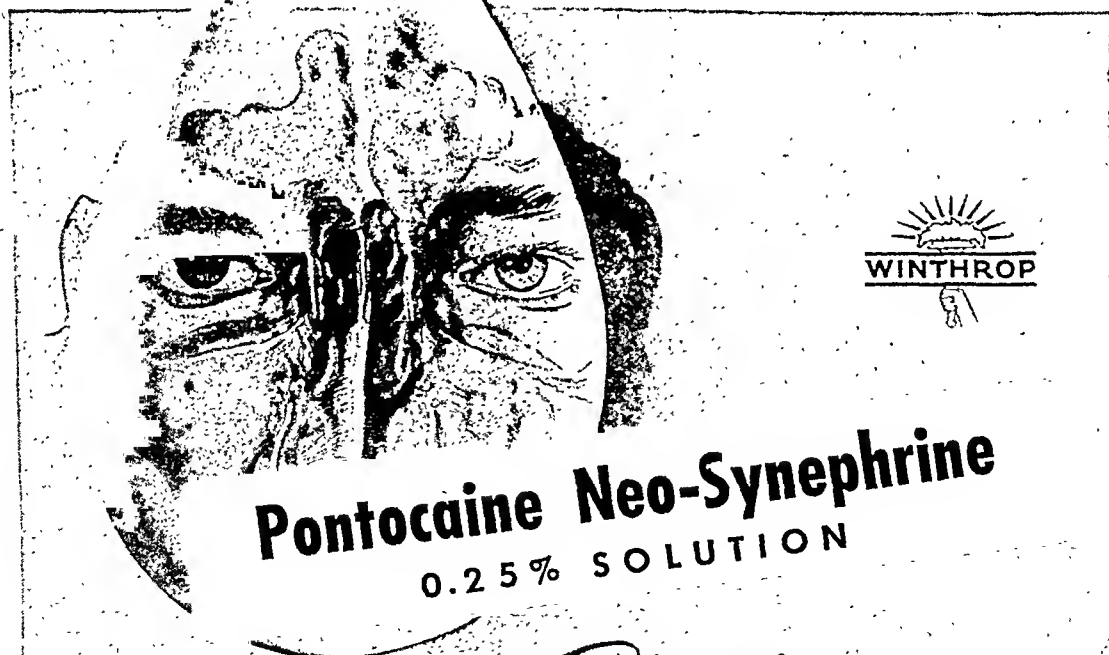
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action*

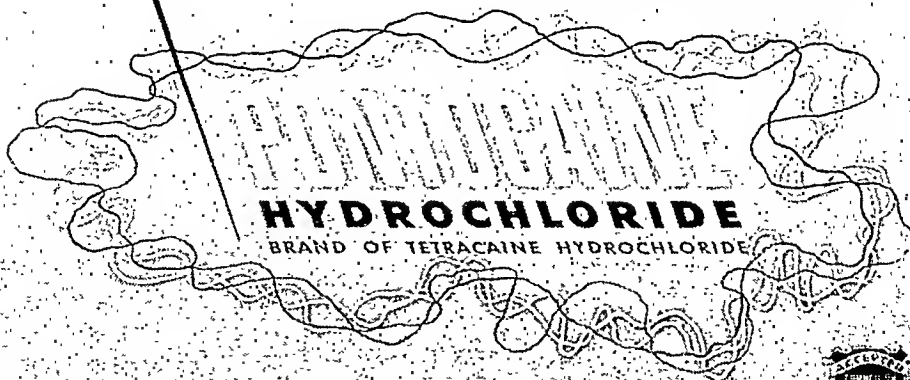


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Preoperative Calm and *Postoperative* Comfort

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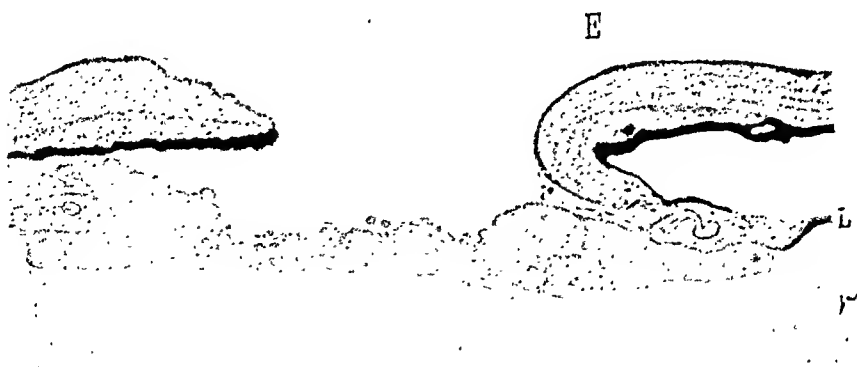


FIGURE 2

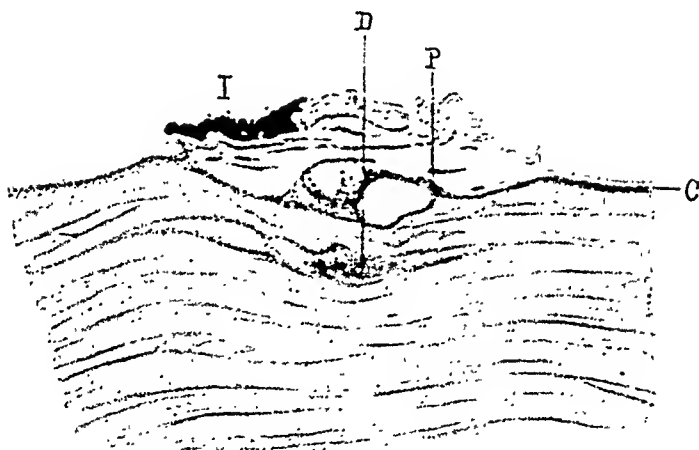


FIGURE 6

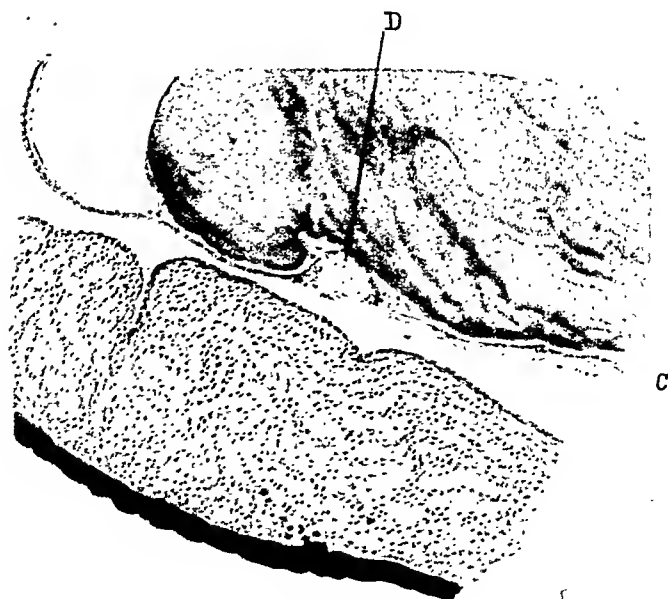


FIGURE 25

PROLIFERATION OF THE EPITHELIUM OF THE LENS*

BERNARD SAMUELS, M.D.

New York

In the early days of the present century, it was decided that ectoderm and mesoderm are different and independent tissues and that the one cannot produce the other. This decision was arrived at largely from experiments made on the cornea. The cornea was employed, first, because it has relatively few cells of its own and, second, because the corneal corpuscles are characteristic and can be readily differentiated from cells that invade the cornea as a result of infection or trauma. The lens was not used in the early experiments because of its inaccessibility within the globe and the impossibility of reaching it without damaging nearby structures. If it had been available, it would have been evident at that time that a strict differentiation between ectoderm and mesoderm cannot always be made. It is possible for the epithelial cells of the lens, when irritated, to lay down a tissue, the anterior-subcapsular cataract, that has more of the

physical qualities of mesoderm than of ectoderm. In later experiments as an object of embryologic investigation, the lens proved to be valuable in revealing the influence of the presence of one organ on the development of another, notably the effect of the retina on the development of the lens. In the cultivation of living tissue the epithelium of the lens has been employed with informative results.

Since the discovery that the lens is the site of cataract and that by its removal blindness can be cured, interest in the anatomy, pathology, physiology, and chemistry of the lens has never ceased. The radical operation of intracapsular extraction has once more directed attention to the physiology of the lens, since after this procedure complications may arise that seem to be caused by the removal of every vestige of this organ. The iris loses its support and may become tremulous. The vitreous may prolapse into the anterior chamber, and the retina may be lacerated and detached by the tremulous vitreous. The pupil may be drawn up as a consequence of complete

* Read before the Oxford Ophthalmological Congress at Oxford, England, July 5, 1946.



Fig. 2 (Samuels). Vesicular cells lying on the posterior capsule freely exposed to the aqueous.

Fig. 6 (Samuels). Anterior subcapsular cataract showing the changing of epithelial cells into fibers and the laying down of intercellular substance. I points to the iris, D to cellular debris, and P to the start of a basal layer.

Fig. 25 (Samuels). A large druselike body at D under the anterior capsule, C. Note the calcified lens which is dislocated and turned around in the anterior chamber.

aphakia. In the extracapsular operation, the preservation of the equatorial zone of the lens has the advantage of providing a cushion known for generations as Soemmerring's crystalline swelling, on which the ciliary zone of the iris may rest. It would seem, therefore, that the lens has functions other than those having to do solely with vision.

SOEMMERRING'S CRYSTALLINE SWELLING

Much information concerning the proliferative powers of the lenticular epi-

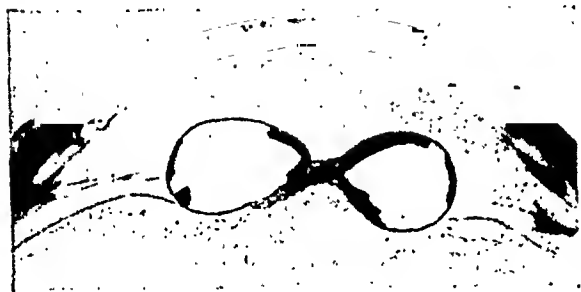


Fig. 1 (Samuels). Soemmerring's crystalline swelling. The nucleus of the lens is replaced by a broad band of dense avascular tissue in the formation of which only lenticular and exudative cells could have taken part.

thelium has been gained from examinations of the lens after the capsule has been opened, and a number of practical problems have been solved. It is known that Soemmerring's crystalline swelling consists of more than left-over lens matter. Within the sealed ring, there takes place a proliferation of the germinal cells, and the younger the lens the more active the process and the more distended and larger the ring (fig. 1). In doing a discission, it is often surprising, if the ring is opened, how great an amount of lens matter escapes. To guard against a secondary membrane in cases of extracapsular extraction, a large piece of the anterior capsule is excised so that no subcapsular cells are left to multiply and change into opaque fibers or to form so-

called pearls of Elschnig (fig. 2, color plate). Unfortunately, after a cataract operation, if the eye remains irritable for a long period, exudative cells from the uvea may be deposited on the posterior capsule of the lens or on the anterior limiting layer of the vitreous. The singular phenomenon is that these cells also produce a connective-tissuelike membrane without there being the least sign that any element from the walls of a blood vessel took part in the process.

MATERIAL

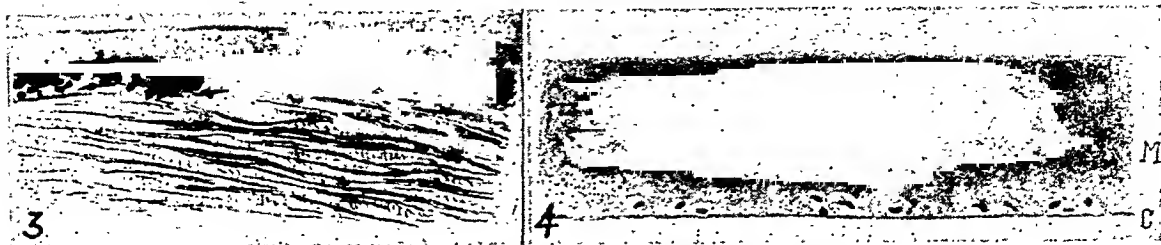
The present paper has for its chief purpose the summarizing of the proliferation of the epithelial cells of the lens in 185 cases of nontraumatic cataract. The cases were arranged in the following manner according to what was believed to have been the main factor in the production of the cataract:

<i>Cases</i>	
1. Ulcers of the cornea	18
2. Corneal scars	35
3. Spontaneous iritis	20
4. Spontaneous detachment of the retina..	23
5. Intraocular tumors	58
6. Glaucoma	31

The six groups have been the subject of as many publications.¹⁻⁶ Scattered through these articles will be found much that is mentioned here, as well as many of the illustrations. Cataracts with a ruptured capsule were excluded from this long and varied list because the moment a capsule is opened, cells may enter from the uvea, as mentioned, and produce a tissue of their own, rendering the picture no longer one of pure epithelial proliferation.

IMPERMEABILITY OF THE LENS CAPSULE

Since this paper concerns exclusively the proliferation of the lenticular epithelium, the question arises as to whether or not the lens capsule is pervious to cells from without. It is certain that, in very severe inflammation, pus cells may pass



Figs. 3 and 4 (Samuels). Fig. 3, Pus cells near the anterior pole of the lens, lying between the subcapsular epithelium and the normal cortical substance. Apparently the capsule was intact. Fig. 4, Phagocytelike cells scattered along the posterior capsule. No hole was found in the capsule.

through the other two glass membranes; namely, Descemet's membrane and the lamina vitrea of the choroid. Leukocytes seem to be able to penetrate Descemet's membrane from either the corneal or the chamber side. The lamina vitrea of the choroid seems to be less permeable than Descemet's membrane. It is a common picture in panophthalmitis to see a focus of pus cells in the choroid congregated against the lamina vitrea detaching the pigment epithelium by fluid but not by pus cells.

There were two cases in which the origin of the cells was doubtful:

Case 1. Leukocytes beneath the capsule. The anterior chamber was filled with pus. A row of leukocytes had insinuated itself between the partially necrotic epithelium and the normal cortical substance (fig. 3). The capsule showed no sign of collapse as it would have done had it been perforated, allowing the escape of lens matter. In the absence of serial sections, the possibility of a hole in the capsule could not be excluded. My belief in the impermeability of the lens capsule to cellular elements remains unchanged.

Case 2. Phagocytes beneath the capsule. A retinoblastoma had filled an infant's eye, causing buphthalmos. The lens substance was liquefied. The remarkable feature was the presence of large, round hydropic cells straggling along the inner surface of the posterior capsule (fig. 4). Each cell had a small oblong nucleus and a foamlike protoplasm that gave it the

appearance of a phagocyte that had taken up lipoid material which is certainly not lacking in the cataractous lens. There was a possibility that these were mononuclear cells which had traversed the capsule. On the other hand, they might have been cells of the capsular epithelium which had migrated posteriorly and changed in the liquefied medium.

In this connection, the lens in one of the cases of malignant melanoma showed how greatly the subcapsular cells may alter. A small, anterior-subcapsular cataract had formed and, nearby, some of the

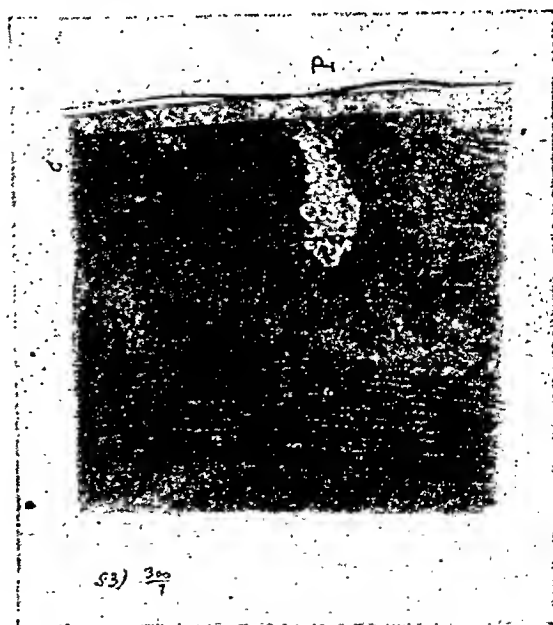


Fig. 5 (Samuels). Transformation of the low-cuboidal subcapsular epithelium into large, round hydropic cells, arranged in the form of a bunch of grapes suspended in the fluid cortical substance.

cells had desquamated. At another spot in the pupillary area, the cells had proliferated and arranged themselves in the form of a bunch of grapes which was suspended from the capsule into the fluid cortex (fig. 5). There was no doubt that they were derivatives of the lens epithelium. They were large, round, and hydropic, and their nuclei resembled the nuclei

mon site for the multiplication of the subcapsular cells and here they attained their highest degree of growth (fig. 6, color plate). Probably these cells have a special inclination to proliferate and, certainly in inflammation of the cornea, they are more exposed to direct irritation than the cells under the iris.

b. Excentric Cataract. The cataract

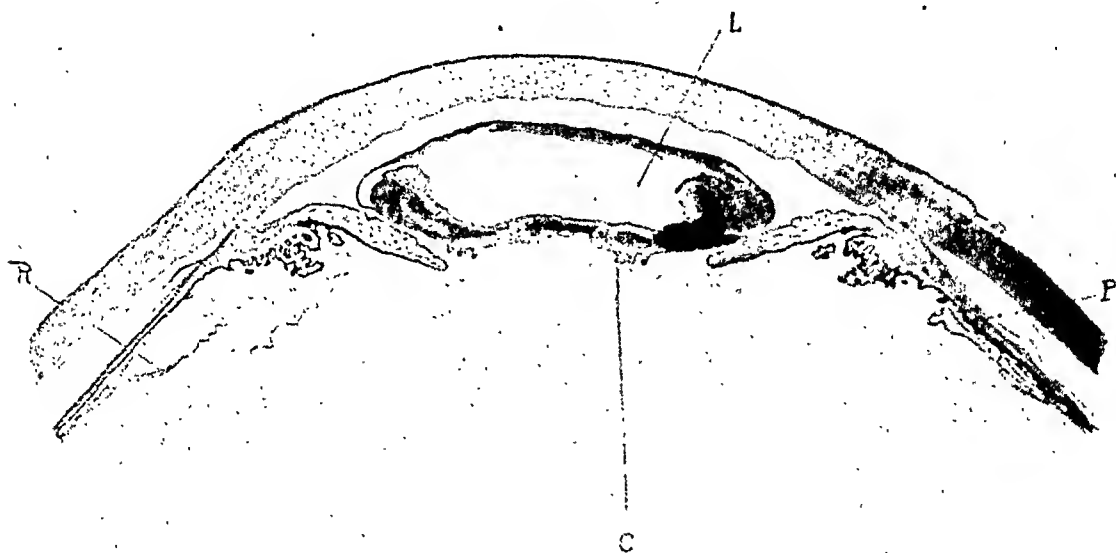


Fig. 7 (Samuels). L points to the lens and C to one of the anterior-subcapsular cataracts. The lens is dislocated into the anterior chamber and is turned around.

of the cells described above. The principal difference was that these cells had not taken up extraneous matter.

PROLIFERATION OF THE LENTICULAR EPITHELIUM

The proliferation was classified as follows: A. proliferation of the anterior-capsular cells; B. proliferation of the germinal cells; and, C. unusual findings.

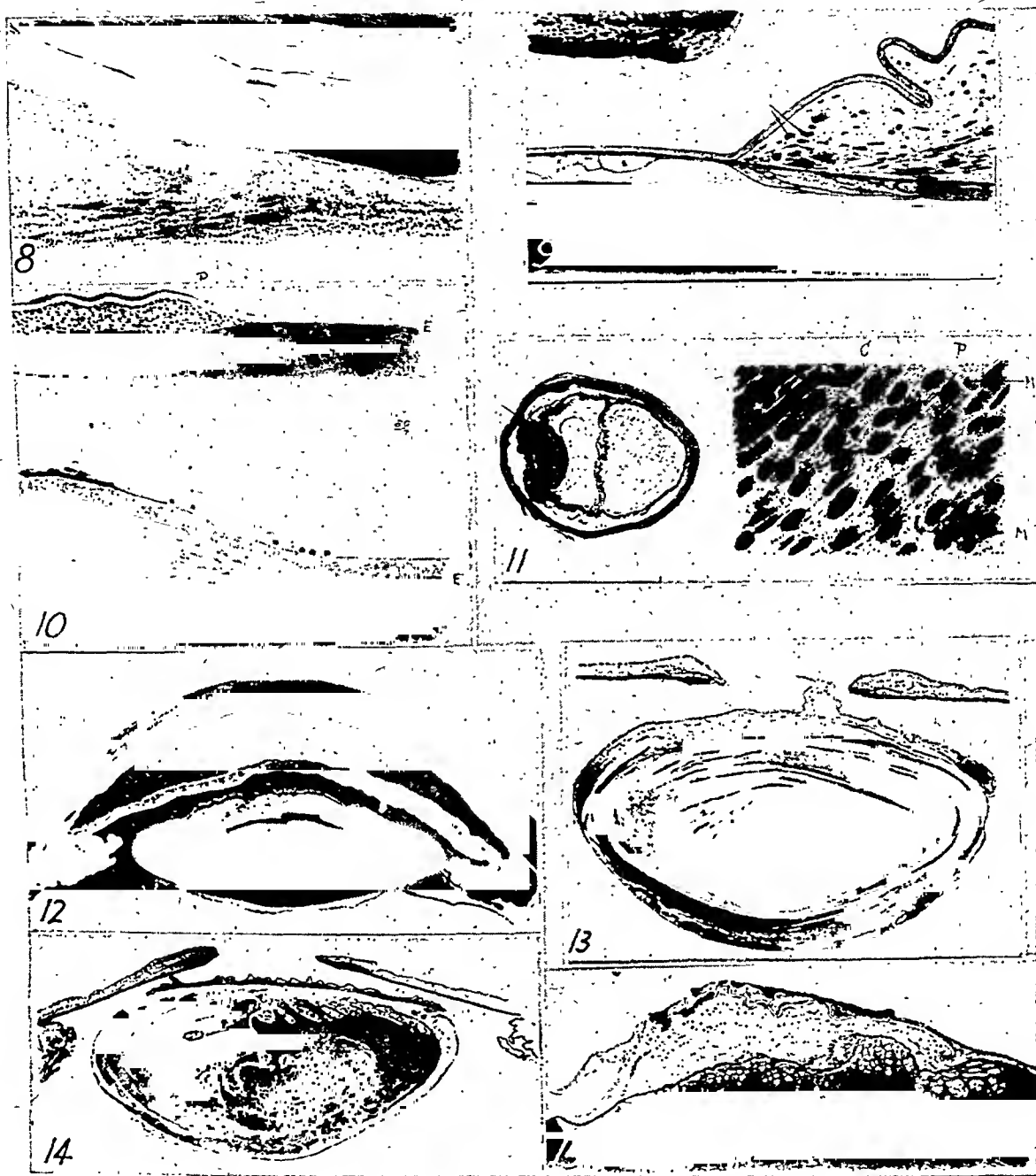
A. PROLIFERATION OF THE ANTERIOR-CAPSULAR EPITHELIUM (SUBCAPSULAR CATARACT)

1. Localization of Subcapsular Cataract

a. Central Cataracts. The center of the pupil was found to be the most com-

mon site for the multiplication of the subcapsular cells and here they attained their highest degree of growth (fig. 6, color plate). Probably these cells have a special inclination to proliferate and, certainly in inflammation of the cornea, they are more exposed to direct irritation than the cells under the iris.

b. Excentric Cataract. The cataract was not invariably composed of one focus of proliferation. For example, in one lens there were two separate cataracts at a distance from the center (fig. 7). Cataracts at the equator were encountered usually as an extension of an anterior cataract. In a case of blindness from metastatic ophthalmia in a boy, aged six years, a cataract grew on the posterior capsule. In the recessus hyaloideo-capsularis there was a large focus of inflammatory cells. Epithelial cells coated the posterior capsule. Adjacent to the focus of cells in the recessus, the epithelial cells laid down a fibrous membrane—a true posterior-subcapsular cataract of ectodermal origin (fig. 8). The transplanted cells had not lost their power



Figs. 8 to 15 (Samuels). Fig. 8. At P there is a mass of exudative cells showing a giant cell to the left. The overlying epithelial cells reacted to the irritation by laying down a connective-tissuelike membrane. Fig. 9. An anterior polar cataract showing the basal layer of flat epithelial cells beneath which are vesicular cells. Fig. 10. In the upper drawing a row of very thin and elongated epithelial cells (E) hug the capsule apparently on their way to the cataract. The lower drawing shows how nuclear a subcapsular cataract is at first. Fig. 11. A cataract caused by sympathetic ophthalmia. The small drawing shows the iris converted into a tumorlike mass and replaced by lymphocytes, plasma cells, and giant cells. In the detail, C points to the capsule, P to the rapidly proliferating cataract, and M to mitotic figures. Fig. 12. The thick and extensive type of anterior subcapsular cataract. Fig. 13. The pyramidal type of anterior subcapsular cataract. Fig. 14. The thin type of anterior subcapsular cataract with a greatly wrinkled capsule. Fig. 15. A very old homogenous anterior subcapsular cataract outlined posteriorly by a row of basal cells beneath which are vesicular cells.

to lay down a connective-tissuelike substance.

2. Rapid Proliferation

Case 1. The most rapidly grown cataracts were seen in cases of corneal ulcers, especially those with a posterior abscess about to rupture. Thus it was in a case of lagophthalmic ulcer in the cornea of a 21-year-old man (fig. 9). Twelve days after the onset, the eye was enucleated because the ulcer had perforated, causing the iris to prolapse. In this brief period, a highly elevated and sharply defined anterior-polar cataract developed, showing already a tendency to contract.

In a second case, the eye of a boy, aged 12 years, was removed three weeks after the onset of a perforated serpiginous ulcer. Here, instead of one patch of proliferation, there were three separate cataracts, each detaching the anterior capsule. The cells bordering the proliferated areas were scanty and exceedingly flat (fig. 10). They were apparently mature cells that had flattened in order to creep along the capsule and replace cells that had disappeared. It is known that newly formed epithelial cells have a directed growth and an inherent tendency to move toward a certain place (positive chemotaxis). It is likely that even fully mature cells may change their shape and show a similar phenomenon of motion. In this instance, the early stage of the formation of an anterior-polar cataract was revealed. The cells were small, compactly disposed, and rich in protoplasm. As yet no intercellular substance had been laid down.

In a third case, one of sympathetic ophthalmia, over-rapid proliferation was shown by the presence of many mitotic figures which resembled the atypical star figures seen in malignant growths (fig. 11). In the entire series, this case and

another were the only ones in which mitotic figures were encountered.

3. Shape and Consistency of Subcapsular Cataracts

Three types of anterior-polar cataract were differentiated in this material: (a) the widespread type with an undulating anterior surface (fig. 12); (b) the pyramidal type projecting abruptly forward (fig. 13); (c) the thin, fibrous type with sharp wrinkles in the capsule (fig. 14). This classification was made according to the contours of the anterior surface. Posteriorly, the outline was always concave, conforming to the outline of the anterior surface of the nucleus. Apparently, the growing cells find it easier to detach the capsule than to indent the nucleus. In its fully developed state, an anterior-polar cataract shows few nuclei and a very abundant intercellular substance (fig. 15). It is indeed an "epithelial connective tissue." It may even have a fine lamination. The older the cataract the more homogeneous it is. Its toughness becomes manifest when attempts are made to tear it. Eventually, it may become calcified just like any ordinary connective-tissue scar. In the matter of staining, it differs from connective tissue in that it takes a yellow instead of a red stain. Chemically, it has the property of the capsule.

4. Reaction to Irritation (Pyramidal Type of Cataract)

The pyramidal cataracts were usually associated with corneal ulcers, especially with those about to rupture. They were the result of short but concentrated exposure to toxins. Simultaneously with the rupture of the cornea come the release of the toxins from the anterior chamber and the arrest of the growth. By contraction, the isolated mass of proliferation

elevates itself and detaches the capsule. However, it affects but slightly the lens nucleus from which it separates easily, merely sliding on it. It may remain of the same size and whiteness throughout life.

An example of the effect of local irritation was a case of serpiginous ulcer in which a wide perforation of the cornea brought good drainage to the anterior chamber (fig. 16). At one point on the capsule, the cornea, with the advancing border of the ulcer, lay in direct contact with the lens, and proliferation of the subcapsular cells was confined to this point. The entire pupillary area of the lens was covered by a coagulum of pus and blood and, under this, the subcapsular cells were well preserved. In the study of the corneal ulcer cases, it was noted that a hypopyon may have the benign effect of forming a curtain that protects the subcapsular cells from the toxins eliminated by the bacteria in the cornea.

5. Reaction to General Irritation (Widespread Type of Cataract)

Extensive proliferation, sometimes reaching beyond the pupillary area, was characteristic of the cases of spontaneous detachment of the retina. An unusually widespread cataract was found in a woman's eye, blind for 25 years due to long lasting toxins from the subretinal fluid (fig. 17). The most interesting point was its association with a similar connective-tissuelike formation at the ora serrata which had been laid down by the pigmented epithelium. A similar tissue may be found posteriorly on the choroid when the retina has been long detached. Occasionally this tissue of epithelial origin may be found in all three locations in the same eye. They are all believed to be the result of a low grade reaction to a prolonged but not virulent stimulus.

6. Basal Cells of Posterior Polar Cataract

In a number of cases, a single layer of more or less cuboidal cells outlined and separated the subcapsular cataract from the lens substance. Being very nuclear, the layer stood out by contrast against the overlying homogeneous cataract. Treacher Collins⁵ found that these

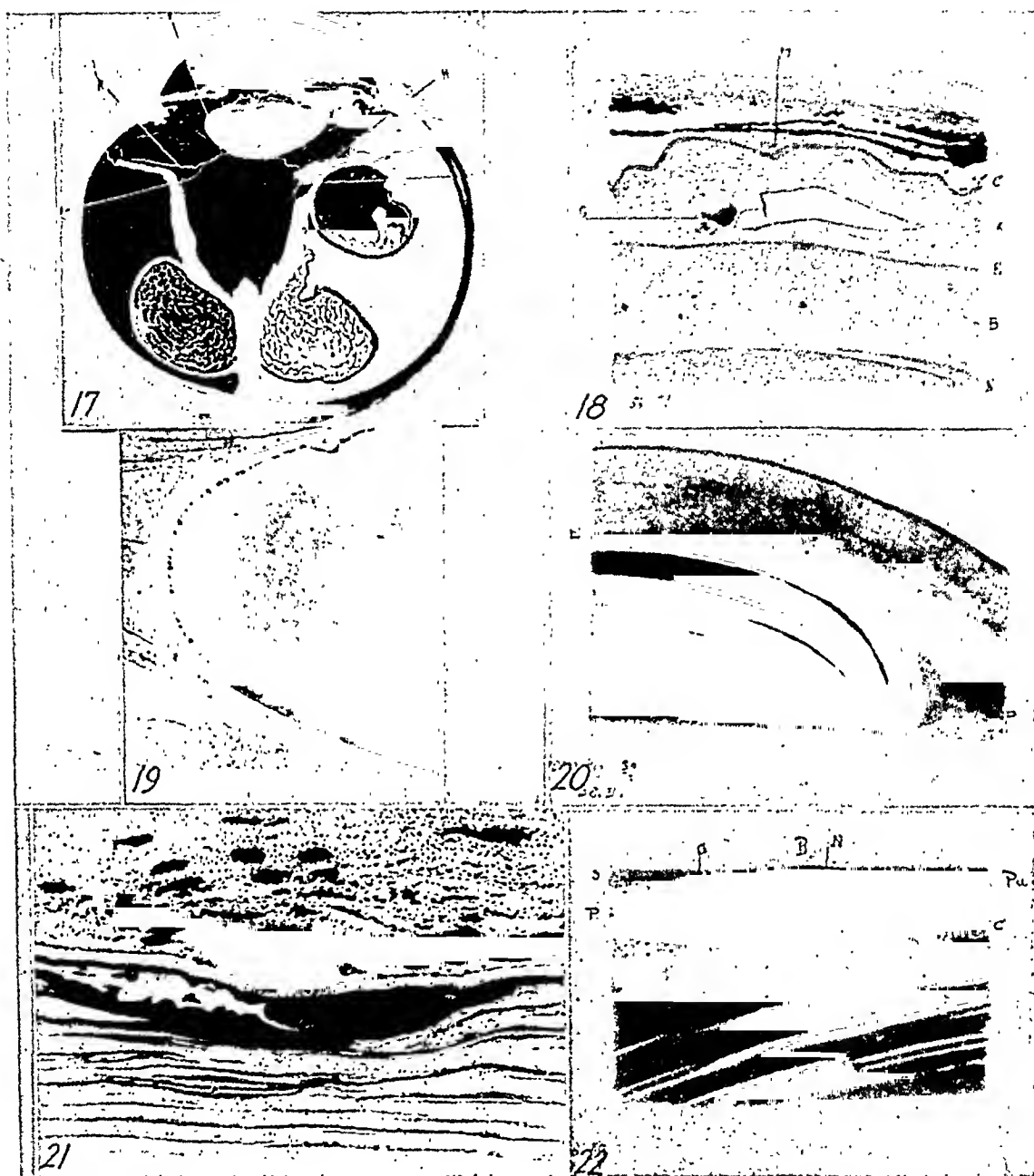


Fig. 16 (Samuels). The cornea has ruptured from a serpiginous ulcer, and the open space is filled with pus and blood. Two cataracts have formed, the larger one directly under the necrotic pupillary border of the iris over which is a posterior abscess in the cornea.

cells could secrete a glass membrane on the posterior surface of the cataract. In the specimens, the basal cells were found only in the late stages of the cataract (fig. 18). They never spread into the cataract and seemed never to have taken part in its formation. Evidently the subcapsular epithelium has a particular urge to wall off and isolate an abnormal mass.

7. Spread of Subcapsular Epithelium Posteriorly

As long as the whorl of the germinal zone in which the epithelial system ends at the equator is preserved, it is not possible for the anterior capsular cells to proliferate posteriorly. However, when the germinal cells have disappeared or have fallen away from the capsule, the anterior cells may then take their place and grow



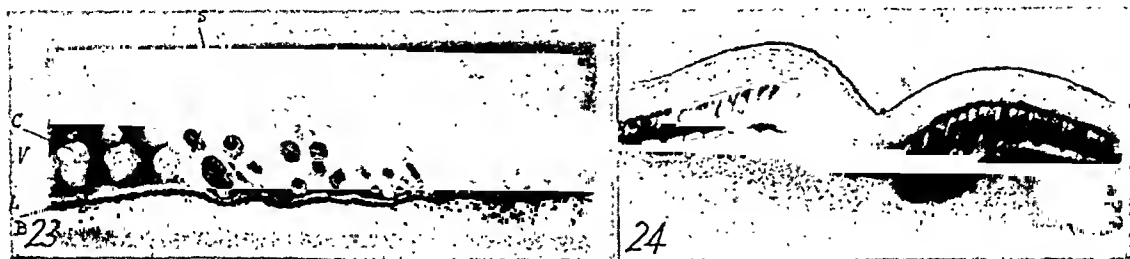
Figs. 17 to 22 (Samuels). Fig. 17. Anterior polar cataract caused by toxins from an old detachment of the retina. Fig. 18. Cystic space lined by flat cells in the midst of an old anterior subcapsular cataract. Fig. 19. The entire capsule is lined by a row of epithelial cells. The thicker capsule to the right is the anterior capsule. Fig. 20. The iris has become necrotic from the sudden cutting off of the circulation in acute glaucoma. Necrosis of the iris followed, causing also necrosis of the underlying subcapsular cells. Fig. 21. Nodules of a homogenous material (drusen) laid down by the subcapsular epithelium under the protection of the iris in a thwarted attempt to cover the denuded pupillary area to the left. Fig. 22. Pu points to the pupillary area and C to the capsule. I points to the iris, P to the pigment layer, and B to broken down pigmented cells. At N, there are desquamated epithelial cells under the capsule, and at G there is a tuft of proliferated cells.

backward to line the posterior capsule in one continuous layer. The migration backward was usually found in association

with liquefaction of the entire cortical substance of the lens, in which condition the germinal zone no longer exists. This

was illustrated in a case of hydrophthalmos in which the substance was totally liquefied, the patient being only 22 years of age (fig. 19). The posterior capsule was lined by a single layer of epithelial cells, so that the two poles could be distinguished only by the difference in thickness of the capsules. In the group of cases of detached retinas, the proliferation backward was frequent as if the cells

pupillary border but being unable to proceed into the denuded area, drew back upon themselves and laid down a homogeneous mass of lenticular shape. Again, in one of the glaucoma cases, a sudden and complete blocking of the angle cut off the blood supply to the iris and caused it to become necrotic (fig. 22). In turn, toxins from the necrotic pupillary zone of the iris, where it touched the capsule,



Figs. 23 and 24 (Samuels). Fig. 23. Vesicular cells along the posterior capsule. C points to the protoplasm of a cell and S to a cystic space in one of the cells. Fig. 24: Distorted subcapsular epithelial cells.

had a purpose to protect the lens from toxins coming from that direction.

8. Proliferation to Repair Defects

Now and then in this long survey, the same lens showed both a stretch of necrosis and an attempt at repair by the adjoining cells (fig. 20). Among the causes of necrosis were toxins from a serpiginous ulcer, pressure of the lens against the cornea in glaucoma, toxins from a necrotic iris in touch with the capsule, and toxins from necrotic tumors. It became evident that it is a trait of the lenticular epithelium, like that of the corneal endothelium, to attempt to repair any defect in its continuity. Such an attempt was demonstrated in a case of lime burn of the cornea followed by a serpiginous ulcer (fig. 21). A purulent exudate filled the anterior chamber, causing the death of the central subcapsular cells. The adjoining cells, spared because they had been protected by the iris, multiplied at the

killed the underlying epithelium. At a distance toward the periphery, where the aqueous separated the iris from the lens capsule, the living cells attempted to repair the damage but, being thwarted, proliferated in the form of tufts of cells.

B. PROLIFERATION OF THE GERMINAL CELLS (VESICULAR CELLS)

In the process of developing flat and slender fibers from the germinal cells at the equator, the cells are pressed against a wall of preëxisting lens fibers. It is pressure that helps to mold the newly formed cells into fibers. In the cases of retinal detachment, since the lens was so frequently liquefied, making the pressure equal in all directions, it followed that it was in this group that vesicular cells were found most often and in greatest abundance (fig. 23). They are large bladderlike cells with a faintly staining nucleus and protoplasm enclosed in a sharply defined cell border. Occasionally they are very much elongated because, after

all, they are but misshapen lens fibers. Their favorite site was at the equator, but often they were located along the posterior capsule, less often anteriorly as if they had been pressed in either direction in the liquid cortex. In the process of disappearing, they lose their nuclei and frequently merge to form a large cystic

and took on a palisadelike arrangement due to traction exerted by the folded and detached capsule (fig. 24).

2. *Drusen of the Capsule*

In two cases, one in the group of spontaneous iritis and one in the group of intraocular tumors, the epithelium was



Figs 26 and 27 (Samuels). Fig. 26. Spherical body of epithelial elements floating in the liquid cortex. Fig. 27. Initial stage in the formation of an anterior polar cataract.

space, for they represent a phase in the development of a total cataract. They were found least often in glaucoma cases in which, as a rule, the lenses were the best preserved.

Metaplasia. Regarding metaplasia, the rapidity with which the epithelial cells changed their character, added to this property of contracting from the start (in one case 12 days), was astonishing (figs. 6 and 28). It was never certain that the anterior cells ever produced vesicular cells, nor was it certain that the germinal cells ever produced connective tissue. Whenever a cataract was found at the equator or posteriorly, it was considered to be the product of wandering anterior subcapsular cells.

C. UNUSUAL FINDINGS

1. *Distortion of Cells by Traction*

In another case in the group of corneal scars, the capsular cells lost their normal cuboidal shape, became elongated,

detached from the capsule by a homogeneous, roundish mass hugging the capsule and taking a similar stain (fig. 25, color plate). It was surprising that only four druselike formations were encountered, showing their rarity.

3. *Epithelial Sphere*

Many times, desquamated cells were noted; and once, the germinal zone detached and fell into the liquefied cortex. In a lens of the group of retinal detachments, cellular elements had agglutinated and formed a large sphere (fig. 26) that in life must have floated about in the fluid, just as an aggregation of endothelial cells may swim freely in the aqueous or attach itself to the iris and propagate.

4. *Incipient Subcapsular Cataract (Anterior-Polar Cataract)*

In a case of malignant melanoma of the choroid, the only changes noted were two small foci of cells under the anterior

capsule. They resembled giant cells with their many nuclei and homogeneous protoplasm (fig. 27). It was considered that they represented the initial stage in the formation of an anterior-polar cataract.

5. Absence of Epithelial Cells

In only two cases among the 185 examined was there a complete absence of epithelial cells. A "dead lens" in the strict sense of the word must be considered one of the rarest of intraocular pathologic findings.

SUMMARY

The lenses that showed the greatest proliferation belonged in the groups of corneal scars, spontaneous iritis, and detachment of the retina. These were the eyes in which a low-grade, chronic alteration in the metabolism had existed over the longest period.

The lenses that showed the least proliferation belonged in the groups of intraocular tumors and glaucoma. Death of the cells characterized the tumor cases, owing to the irritant poisons eliminated by the tumors as they became necrotic.

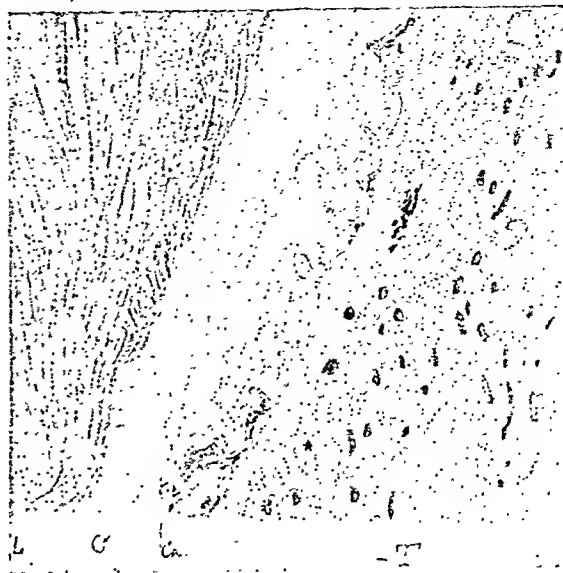


Fig. 28 (Samuels). A case of tuberculosis of the cornea. The anterior chamber is filled with granulation tissue containing giant cells. An extensive anterior-polar cataract has thrown the lens capsule into numerous deep folds.

That multiplication of cells was seldom seen in the glaucomatous globes was probably due to the fact that the cells were compressed between the swollen lens substance and the distended capsule. This may be the reason that, in glaucoma cases, an anterior-polar cataract is a clinical rarity.

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GLAUCOMA CAPSULARE*

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Some 20 years ago, Vogt coined the term "Glaucoma Capsulare" to describe a condition that he had observed in 17 cases. These presented a more or less typical form of simple glaucoma, to which was added the picture of exfoliation of the anterior capsule of the lens. He very shrewdly deduced that the debris of exfoliated material closed the outlets of the angle of the anterior chamber and thus produced the hypertension. This was purely theoretical on his part, for no gonioscopic examinations were made of these patients. He thought correctly, however, for the examination of the angle of the anterior chamber has suggested that his deductions are correct and but little has been added to the picture as he originally described it. Time, experience with a larger number of patients, and refinement of methods of examination have rounded out the picture so that today the disease known as Glaucoma Capsulare, may be regarded as an entity. The present total number of cases studied by us is 77, an addition of 26 to our previous series.

Before discussing the condition itself, it might be well to speak of its etiologic aspect, namely exfoliation of the anterior capsule of the lens. This in itself has been known for well over 100 years, although not in its relation to the disease under discussion, and has been the subject of much investigative work. The historic phase and the large bibliography were discussed in an article by Gradle and Sugar¹ and consequently need not be repeated here. The observations made previously

as to racial incidence have been amplified slightly. So far, we have seen only two instances of Glaucoma Capsulare in Negro Americans. The previous high incidence of Glaucoma Capsulare in patients of Greek birth (8 patients, 15.7 percent) of the original series, remained the same (12 patients, 15.6 percent) in the enlarged series. This is interesting in view of Trantas' finding of exfoliation in 18 percent of 237 Greek patients over 55 years of age.

ZONES OF CAPSULAR EXFOLIATION

Capsular exfoliation occurs in a relatively small number of patients, usually past the age of 55. It is manifested as an elevated scruffing on the anterior surface of the anterior lens capsule which represents a separation and opacification of the anterior layers of the anterior lens capsule. In all likelihood the condition is a result of senile degeneration, although the frequency of unilateral occurrence places some doubt on this idea (18 cases in this series).

The capsular exfoliation occurs in five distinct zones of the capsule. One, and sometimes two of the five, can be seen *only* gonioscopically. They may be listed as follows:

Zone I. There is a central annular disc on the anterior capsule of the lens, varying from 1 to 2.5 mm. in diameter. This is fairly translucent and usually homogeneous, although there may be a few white specks near the periphery. The edges are sharp and sometimes have a tendency toward curling. The size of the disc is apt to depend upon the size of the pupil, and it is sufficiently transparent so that there is no interference with vision.

* From the Illinois Eye and Ear Infirmary, Chicago. Under a grant from the W. K. Kellogg Foundation. Presented in part before the IVth Brazilian Congress of Ophthalmology, June, 1941.

Zone II. This is a fairly narrow, clear zone that surrounds the central disc. There is never any uniform opacity in this area, but mainly capsular shreds that are apt to be disengaged from their base. The semiopaque shreds are frequently arranged radially, corresponding possibly to the radial folds of the posterior surface of the iris. Owing to the movements of the iris under normal light stimuli, the exfoliations of this zone are usually partly or completely rubbed off, leaving the area clear. It is most probable that the majority of the shreds found floating in the aqueous have their origin from this area.

Zone III. This zone varies in size and, in the untreated eye, appears to begin about 3 mm. from the axis of the lens. It extends fairly well into the periphery, depending upon the extent to which the posterior surface of the iris is in contact with the anterior lens capsule. The entire area of the zone is apt to be involved, and the appearance of the exfoliations suggested the original term of "Kapselhautchen." In other words, it appears to be a fairly opaque membrane that resembles a very fine gray and white honeycomb. The central edge is frequently lifted and curled and from this edge come some of the capsular shreds that are found free in the aqueous, as is shown by the irregular and frayed character of the axial edge.

Zone IV. Extending well up to the anterior insertion of the zonule of Zinn fibers is this narrow translucent zone with only irregular radial opacifications from Zone III extending into its axial portion. This zone can be seen only through a coloboma of the iris or else gonioscopically in iridectomized eyes. It does not play any role in the production of glaucoma.

Zone V. This lies around the equator of the lens between the insertions of the

anterior and posterior zonule fibers. The exfoliation here is the same as in Zone III. However, it seems unlikely that the exfoliations here are much concerned in the production of Glaucoma Capsulare. Opacification of the zonule fibers, themselves, is always present, when visible gonioscopically.

When the exfoliations are still adherent to the capsule from which they originate, their appearance varies from thin, flocculent shreds to that of a semicystic membrane that resembles a very fine mesh honeycomb. Histologically, it has been proved by numerous investigators that the exfoliations represent the outermost laminae of the anterior capsule of the lens. These are elevated by the development of vacuoles within the anterior layers of the capsule as was shown by Sobhy Bey in 1932.² The vacuoles then rupture under the influence of the rubbing movements by the posterior surface of the iris and the broken edges retract and curl up. As the movements continue, the exfoliations become loosened and float away in the normal aqueous current. It was interesting to note that, in one unoperated patient who had been on miotics for six years during the war, further vacuole formation occurred in the clear area of Zone II and was not rubbed off due to immobilization of the iris.

Apart from their appearance on the lens capsule, shreds of exfoliations of the capsule are frequently seen adherent to the iris. They seem to be somewhat tenacious in character and frequently become adherent to whatever portion of intraocular tissue with which they come into contact. As a result, the majority of the shreds are found on or around the pupillary border of the iris in a fairly fixed position. Occasionally one can be seen lying on the anterior surface of the iris. In some instances, we have seen them

adherent to the posterior surface of the cornea, either in the central areas or in the chamber angle.

Thus is explained the origin of what may be termed "foreign matter" in the anterior chamber of the eye. As the natural flow of the aqueous is toward the angle of the anterior chamber, it is perfectly proper to recognize that such foreign particles, aided by gravity and convection currents, will eventually come to lodge in the angle. The presence of these exfoliated shreds on the trabecular wall has been shown gonioscopically. In addition, there is always present a dense pigment ring due to the deposition of rubbed-off pigment granules in the trabecular spaces. The presence of both probably causes mechanical blockage of the spaces.

It stands to reason that not every case of exfoliation of the anterior lens capsule will develop hypertension, as Vogt originally contended. As the exfoliated material and pigment gradually block the trabecular spaces, the normal amount of drainage of the aqueous is lessened. But that decrease is compensated for by drainage through the remaining open spaces and probably by absorption through the crypts of the anterior surface of the iris. Only when the total drainage area has been reduced to a point where the production of the aqueous is greater than the possible elimination, does the intraocular pressure begin to increase. The process is slow, however, and probably requires years before the balance of intraocular pressure is disturbed. Consequently, there is no sudden rise in tension such as is found in an acute blockage of the chamber angles, but rather a slow increase in pressure with consequent vascular compensation.

COINCIDENTAL ACUTE GLAUCOMA

In only two cases of capsular exfoliation have we seen acute glaucoma occur.

Both had shallow chambers and angles and should be considered as "primary" acute glaucomas and not as Glaucoma Capsulare. The exfoliation was probably coincidental in each instance.

The case histories of the patients with capsular exfoliation and coincidental acute glaucoma follow:

Case 1. C. C., aged 66 years, experienced a sudden attack of acute pain in his left eye and noticed rings around lights on May 18, 1940. This patient was seen at the Illinois Eye and Ear Infirmary four days later. The tonometric readings were 25 mm. Hg (Schiotz) for the right eye; and 73 mm. for the left. All the typical findings of a congestive attack of acute glaucoma were present in the left eye. Both anterior chambers were shallow. Capsular exfoliation was present in each eye. The left eye did not respond to miotic therapy but remained normal after an iridectomy.

Case 2. J. F., aged 71 years, suddenly noticed poor vision in his right eye in September, 1939. On examination the tonometric reading for the right eye was 60 mm. Hg (Schiotz). Both anterior chambers were shallow. Eserine rapidly brought the tension to 32 mm. Typical capsular exfoliation was present in the right eye only. The lens of the right eye was cataractous and was operated upon. In spite of an open angle, the right eye responded like most eyes with Glaucoma Capsulare with slightly increased tension.

In March, 1946, the patient was being prepared for removal of a cataract from the left eye, the one without capsular exfoliation. Preoperative dilatation of the pupil of the left eye caused an elevation of tension from 25 to 49 mm. Hg (Schiotz) in two hours and return to normal after eserine.

In two other cases, vascular decompensation occurred, probably as a break in the vascular compensation of a previously long-standing Glaucoma Capsu-

lare. In these cases, the chambers were deep and the angles open. In one case, that of J. L., aged 65 years, there were no symptoms except for decreased vision over a long period, until three weeks before examination in 1939. At this time, the left eye became painful. The vision was 9/200 in this eye and could not be improved. The lens was clear. The disc was deeply cupped. There was no evidence of any abnormal narrowing of the angle. In the second case, that of J. P., aged 65 years, in 1938, the visual acuity of the left eye began to decrease 13 years previously. Two years later the eye was amaurotic. There was no pain until February, 1936, when the tension of the left eye was 77 mm. Hg (Schiotz). The eye was red without evidence of an inflammatory or angle-block basis. A trephining operation was done on this eye.

In just what percentage of cases with capsular exfoliation glaucoma develops, it is impossible to say. In our series of 77 cases of exfoliation, glaucoma developed in 63 (81.8 percent). In the literature, the incidence varies from 14.0 percent (Alling³) to 90.0 percent (Busacca⁴). Inasmuch as the exfoliation usually can be detected only with slitlamp or loupe, and then often requires pupillary dilatation, it will be necessary to examine many thousand patients to determine the exact percentage that develop glaucoma. One of us (H. S. G.) has followed a patient with capsular exfoliation for 18 years and has never found hypertension, nor has her lens opacity progressed to a point necessitating extraction. On the other hand, we have observed the development of glaucoma in four patients with exfoliation after several months of observation. We may not say with any degree of certainty that the presence of capsular exfoliation always presumes the eventual development of glaucoma but, at least, glaucoma does occur in a large percentage of cases.

Conversely, we do not know what percentage of cases diagnosed as simple glaucoma are of the type which are really Glaucoma Capsulare. In our previous series of simple glaucoma in the glaucoma clinic of the Illinois Eye and Ear Infirmary, there were 331 cases up to July 31, 1940, as compared to 46 cases with Glaucoma Capsulare. It appears that about 7.2 percent of the cases heretofore diagnosed and treated as primary simple glaucoma are, in reality, secondary glaucoma of the type known as capsular and requiring, in many instances, a different form of therapy.

DIFFERENTIATION BETWEEN SIMPLE GLAUCOMA AND GLAUCOMA CAPSULARE

There are but few distinguishing characteristics between primary simple glaucoma and Glaucoma Capsulare as regards their course, and these have to be detected by slitlamp and gonioscopic study. Both conditions are insidious in nature, and patients having each type are often not seen until one eye has become totally blind. There is a tendency to spontaneous and operative dislocation of the lens and to the occurrence of asteroid hyalitis in eyes with capsular exfoliation, not in simple glaucoma. Asteroid hyalitis was present in 7 patients of the 77 examined by us. In two, there was spontaneous dislocation of one crystalline lens. In several, the dislocation occurred just after section during cataract operations. In those instances where the capsular exfoliation was unilateral, the vitreous opacities were present only in that eye and not in the normal eye.

The visual acuity and visual field changes that develop are comparable to those of simple glaucoma; they are due to the influence of pressure, purely and simply. However, in Glaucoma Capsulare there is apparently a tendency for the pressure changes to occur with lower intraocular pressure, even pressures ordinarily

considered to be within normal limits. An example of such a case follows:

W. K., aged 78 years in 1939, had noticed, in 1936, that vision in the right eye, previously normal, was entirely gone. When seen at the Infirmary in February, 1937, the right eye was amaurotic; vision in the left eye was 20/20. The tonometric readings were 44 mm. Hg (Schiotz) for the right eye; 29 mm. for the left. The visual field of the left eye for a 3 mm. white target was normal. Tension in the left eye thereafter remained between 16 mm. and 28 mm. (28 once), yet the visual fields gradually decreased, concentrically, to 50 degrees, temporally, and 40 degrees, nasally, with the same target. Visual acuity remained at 20/30 until last seen in March, 1943.

Provocative tests in cases of Glaucoma Capsulare give the same results as in simple glaucoma (except, of course, in mixed cases). Anterior-chamber puncture was positive, while dilatation tests were negative in the following case:

J. U., aged 75 years, began to notice failing vision in 1936. When examined at the Infirmary in April, 1939, the visual acuity was 3/200 right and 20/25 left, corrected. Tonometric readings were 24 mm. Hg (Schiotz) for the right eye; 48 mm. for the left. On miotics the tension remained controlled, usually. Provocative dilatations with euphthalmine and homatropine were negative. Anterior-chamber puncture of the right eye gave the following results: Tension before puncture 23 mm.; tension one-half hour after puncture 10 mm.; one hour after puncture 21.5 mm.; 1½ hours after puncture 60 mm.; two hours after puncture 60 mm.; 2½ hours after puncture 60 mm. The aqueous volume removed on puncture was 0.24 c.c.

In another case of Glaucoma Capsulare with shallow anterior chambers, the response to anterior-chamber puncture was

of the type usually obtained in eyes with simple glaucoma with very shallow chambers.⁵ This patient, E. McD., aged 75 years, was seen at the Infirmary in August, 1939. There was negative response to pupillary dilatation with euphthalmine and homatropine. Anterior-chamber puncture of the right eye gave the following results: Tension before puncture was 28 mm. Hg (Schiotz). Withdrawal of 0.15 c.c. of aqueous was followed by tonometric readings of 8 mm. in one-half hour; 28 mm. in one hour, 32.5 mm. in 1½ hours; 37.5 mm. in two hours; and 35 mm. in 2½ hours.

With the slitlamp, exfoliated shreds may be seen adherent to the posterior surface of the cornea, usually nearer the periphery than the center. Similar small shreds may be found floating in the convection currents in the anterior chamber. The appearance of capsular material adherent to the iris was mentioned previously, but care must be taken to differentiate these shreds from the small gray nodules or tags that are seen so frequently in chronic cyclitis. Free pigment granules are seen very frequently. They may be adherent to the posterior surface of the cornea, may be floating freely in the aqueous, or may lie on the surface of the iris. Such granules are very minute, are light brown in color, and do not seem to have any tenacious qualities.

With the gonioscope itself, the differentiation between Glaucoma Capsulare and simple glaucoma is usually possible. In both types, the angle is usually of normal depth, at least in unmixed cases. In Glaucoma Capsulare, the angle usually presents a more or less characteristic appearance of slight veiling due to the presence of exfoliated lens-capsule material and a characteristic dense, trabecular pigment ring produced by the deposition of pigment granules in the trabecular spaces.

Adhesions are not usually present in the chamber angle in unoperated cases of Glaucoma Capsulare, except in the few instances where congestion has supervened in long-standing cases. Even after operative procedures have been performed, there is comparatively little tendency for the formation of these adhesions, probably due to the insulating effect of the minute capsular particles on the angle wall.

In addition to the above findings in the anterior segment, changes occur in the lens and vitreous. The lens contained within the capsule may be perfectly clear, but usually shows beginning opacities, not infrequently of the posterior-subcapsular type. Among the characteristic findings of a true Glaucoma Capsulare, these lenticular opacities play no diagnostic roles. However, more or less degeneration of the vitreous is always present. This may be comparatively minor and represented only by slight degeneration of the normal fiber structure; or again, there may be extensive degenerative changes, including asteroid hyalitis, or marked fluidity. In a large share of the cases, there is sufficient opacity of the lens so that the vitreous cannot be studied accurately and only when the lens is removed will the degenerative phases of the vitreous become manifest.

Cupping of the optic nerve heads proceeds apace with the amount and duration of the hypertension. As is well known, an acute increase in pressure does not cause a pathologic excavation of the disc. This results only from long-continued pressure that is above the resistance point of the lamina. The visual acuity and visual-field disturbances that are found in Glaucoma Capsulare are a direct result of the pressure increase and resultant cupping of the nerve head.

The successful management of Glaucoma Capsulare requires rather keen

judgment on the part of the ophthalmologist. The majority of cases require surgical interference, and the patient must be carefully informed that vision can only be maintained at its present level, as far as the effects of the glaucoma itself are concerned, but not improved. A few cases can be controlled successfully by the use of a miotic of sufficient strength and frequency of instillation to hold the pupil contracted and rigid. The effect in those cases is the same as in simple glaucoma but, in addition, there is resultant failure to rub off any more exfoliated material, thus preventing further clogging of the trabecular spaces. Only in the early cases, however, and in those in which the hypertension has caused but little damage is that treatment adequate.

In many cases, some form of surgical procedure is indicated. If cataract is present, lens extraction should be performed if the tension can be reduced preoperatively. Otherwise, a cyclodialysis or filtering operation must be performed first. Since there is a tendency for the drainage path to be closed by further exfoliated shreds carried there from the lens surface by the newly diverted current of the aqueous, any glaucoma operation must be followed by the constant use of miotics to prevent further exfoliation from the capsule. In view of the tendency for progressive loss of vision and field even without much elevation of intraocular pressure, surgery should be resorted to if definite progressive field changes are found.

It is interesting that, in spite of the idea that lens extraction is advocated in the treatment of Glaucoma Capsulare, the actual lens removal has no great effect on the ocular hypertension. Of 16 eyes in which the lenses were removed, 14 had tonometric readings of over 30 mm. Hg (Schiotz), as indicated in Table 1, at least once postoperatively. Fortu-

TABLE 1
RESULTS OF LENS REMOVAL IN GLAUCOMA CAPSULAR CASES AT THE ILLINOIS
EYE AND EAR INFIRMARY

Name	Highest Tension Preoperatively mm. Hg (Schiötz)	Type of Operation	Description of Chamber Angle, Postoperatively	Highest Tension, Postoperatively	Method Used to Relieve Tension
1. C.G.	45	Extracapsular	—(1937)	52	Cyclodialysis plus miotics
2. J.F.	60	Extracapsular	Partly open	38	Miotics
3. G.D. (R)	32	Intracapsular (vitreous loss)	Partly open, obliterated only in wound area	37.5	Miotics
4. G.D. (L)	76	Intracapsular (vitreous loss)	Palpebral fissure too small	46	Cyclodialysis repeated
5. B.P. (R)	26	Intraocular	Partly open	32	Miotics
6. B.P. (L)	32.5	Loop	Open below, obliterated upper half	32.5	Miotics
7. F.U. (R)	45	Extracapsular	Partly open	33	Miotics
8. F.U. (L)	32	Extracapsular	Partly open	35	Miotics
9. J.P.	48	Extracapsular	Open below, closed upper half	53	Miotics
10. M.S.	19	Extracapsular	Partly open, partly trabecular adhesions	52	Miotics
11. T.F. (R)	35	Intracapsular	Not seen	30.5	Miotics
12. T.F. (L)	48	Extracapsular	Partly open	30.5	Miotics
13. A.T. (R)	40 (normal after trephining)	Extracapsular	Partly open	33	Miotics
14. C.C. (L)	73 (normal after trephining)	Extracapsular	Partly open	29	None
15. A.McK. (L)	24	Intracapsular	Not seen	10 (1 month followup)	None
16. E.McD. (R)	28.8	Extracapsular	Open except for trabecular adhesion	38	Miotics

nately 12 were controlled with miotics and only two required cyclodialysis. Of course, removal of the lens does remove the possibility of further exfoliation and further trabecular blockage, but lens removal in cases of capsular exfoliation is not without danger because of the great

tendency toward lens dislocation and the loss of fluid vitreous, especially with intracapsular operations.

Such is the picture of the clinical entity now recognized fully and known as Glaucoma Capsulare. Only time can tell how frequently the condition occurs. Certain

it is that Glaucoma Capsulare is not rare overlooking the diagnostic points.
and that we must be on guard to prevent 58 East Washington Street (2).

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ESERINE: ITS HISTORY IN THE PRACTICE OF OPHTHALMOLOGY*

(PHYSOSTIGMINE: PHYSOSTIGMA VENENOSUM (BALFOUR): (CALABAR BEAN))

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No drug employed in the practice of ophthalmology offers such a fascinating story to the medical historian as eserine. By the irony of fate this substance, which was used as an ordeal poison by primitive peoples, later proved to be one of the most effective agents in therapy of the eye. The natural product from which the drug was derived is *Physostigma venenosum* (Balfour) or Calabar bean. After extensive experimentation and observation, the active principle physostigmine was isolated by Fraser¹ in 1863, and made to serve a great variety of medical therapeutic needs. Foremost among these was oculotherapy, and at the present time eserine (physostigmine) maintains an unchallenged place as a miotic.

The need of a miotic was recognized by the early ophthalmologists and, as late as 1861, Stellwag von Carion² in his famous textbook lamented the fact that: "We possess no means of effecting contraction of the pupil." Synthesis of the

drug was accomplished in 1935 by Julian and Piki.³

Trial by ordeal is a practice of extremely ancient origin. It may be generally stated to have been exercised in every country and by every race from early barbarity and to persist to some degree even today. The ancient annals of Greece (*Antigone* of Sophocles, volume 270) tell of its existence. The Bible contains one of the earliest accounts of such a trial, at which a "cup of bitter water" was commanded to be drunk for the detection of conjugal unfaithfulness (*Book of Numbers*, chapter 5, verses 17-31). In Hindustan, China, Japan, Java, the Canary Islands, and many other lands, various forms of ordeal were, and perhaps still are, utilized. In Europe, notably in England, the practice remained in force until the 13th century, when, during the reign of Henry III, a law was reportedly passed for its abolishment (*Blackstone's Commentaries*, volume 4).

Ordeals may be classified under two great headings: those in which application is external, and those in which it is in-

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ternal. The first class includes the well-known trials by fire, water, combat, and the balance. The second, comprising perhaps the most curious and interesting forms, encompasses a large section of the vegetable ordeal poisons. Some of these are beans, nuts, barks, roots, and trees, and it is to this group that the Calabar bean belongs.

Calabar bean is the seed of a leguminous plant, *Physostigma venenosum* (Balfour), indigenous to tropical Africa. The climbing plant grows to a height of about 50 feet on a stem one to two inches thick. The seed pods are six to seven inches long, each containing two or three chocolate-colored seeds or beans about the size of a broad bean. Nothing in the appearance, taste, or smell of the Calabar bean distinguishes it from the harmless varieties which it resembles.

PHYSIOLOGIC EFFECTS

Eserine does not affect unbroken skin. Ingestion of it at first greatly increases salivation by its direct action on secretory cells; then arrests it, due to the constricting effect of the drug on the blood vessels supplying the salivary glands. The secretion of bile, tears, and sweat is likewise affected. A rise in blood pressure occurs. The pharynx becomes constricted, and vomiting and purging ensue. The spleen, uterus, bladder, and iris are also involved. Early, the heart beat is reduced in rate secondary to stimulation of the terminals of the vagus nerve; later, depression of the intracardiac motor ganglia prolongs diastole and eventually halts the action of the heart in dilatation. The initial influence of eserine on respiration is that of acceleration, owing to stimulation of the pulmonary ending of the vagus. This condition is supplanted by retardation and ultimate arrest of breathing when paralysis of the respiratory center in the medulla oblongata takes place, en-

hanced by contraction of unstriated muscular tissue in the bronchial tubes and accumulation of increased bronchial secretion. Action on muscular tissue is direct, since it can occur in the presence of motor-nerve paralysis, and very large doses are required to produce voluntary-muscle intoxication or tremor.

The medulla is apparently the highest level of the brain affected by eserine, and consciousness is not altered. However, spinal-cord reflexes are abolished due to the direct influence of the drug on the cells of the anterior cornua. Reduced sensitivity shortly before death corresponds to sensory-cord paralysis.

Daniell,⁴ a British Army medical officer stationed at Calabar, was first to observe the use of the Calabar bean. William Freeman Daniell was born in Liverpool, in 1818. In 1841, he became a member of the Royal College of Surgeons of England, and entered the medical service of the British Army. He served on the pestilential coast of West Africa and returned to England in 1863. Later, he accompanied the "Expeditionary Force" to China, and was present at the taking of Peking. A short time afterward he travelled to West India; on his next homecoming his health was broken, and he died in 1865.

While in foreign service, Daniell collected and described many native plants. His publications are concerned with the plants, trees, shrubs, and their fruits which were indigenous to the countries visited by him. One of his treatises deals with the Katemfé or miraculous fruit of the Sudan, which was afterward named *Phrynium Danielli*, Benn., in compliment to the botanist who first studied it.

Daniell first observed the use of the Calabar bean in native judicial procedure about 1840. A communication read by him before the Ethnological Society of Edinburgh, in 1846, contains the first

known record of its application.

Old Calabar (fig. 1) is a district of West Africa in the neighborhood of the Bight of Biafra, which extends along the course of a large river, the Rio Calbary, Old Calabar, or Oude Calburgh. It is situated between 4 and 8 degrees North latitude, and 6 and 12 degrees East longi-

were middle men between the white traders on the coast and the tribes of the Cross River and Calabar district. Until 1904, Calabar was generally and officially known as Old Calabar to distinguish it from new Calabar; the name of a river and port, some distance to the east.

Old Calabar was a despotic monarchy,

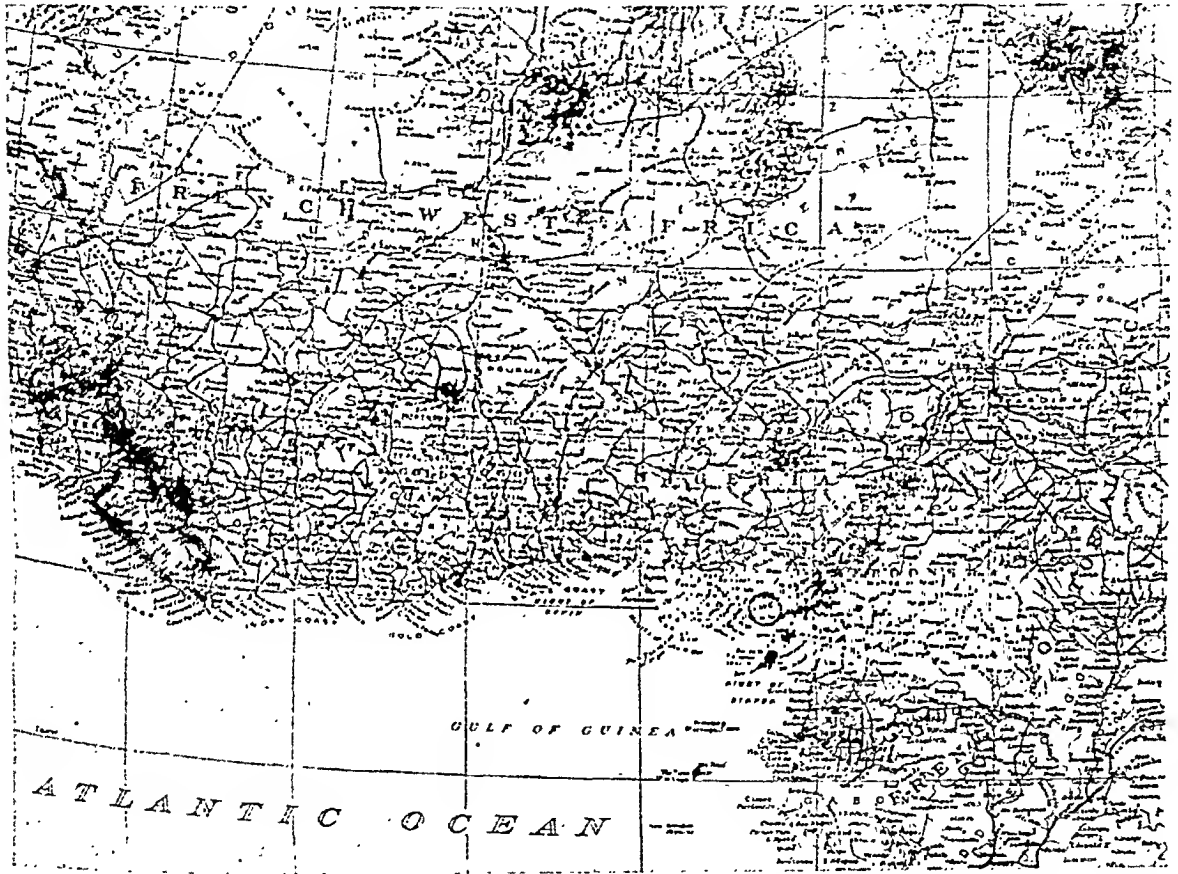


Fig. 1 (Rodin). Map showing location of Calabar (center of the circle). It is located on the river Calabar, a district of West Africa in the neighborhood of the Bight of Biafra.

tude; its estimated length is 100 miles and its breadth, 50.

Calabar was the name given by the Portuguese discoverers of the 15th century to the tribes of this part of the Guinea coast. It was not until the early part of the 18th century that the Efik, after the civil war waged against the Ibibio, migrated from the neighborhood of the Niger to the shores of the River Calabar. The native inhabitants are still mainly Efik. For several generations, they

whose court of justice was composed of its king and elders. Prisoners judged by this body and decided guilty of certain offenses were obliged to swallow a deadly poison. This poison was obtained by grinding and macerating in water the seeds of the Calabar bean, called Esére by the natives, until the solution was milky white. After the prisoner had swallowed the poison, he was made to walk continuously until the poison took effect. If, however, after the lapse of a prede-

terminated period the accused vomited the poison, his innocence was considered vindicated, and he was freed of his charge.

Robert Christison⁶ (fig. 2), in 1855, was first to experiment with the Calabar bean. He was born in Edinburgh, in 1797, the son of a professor of humanity

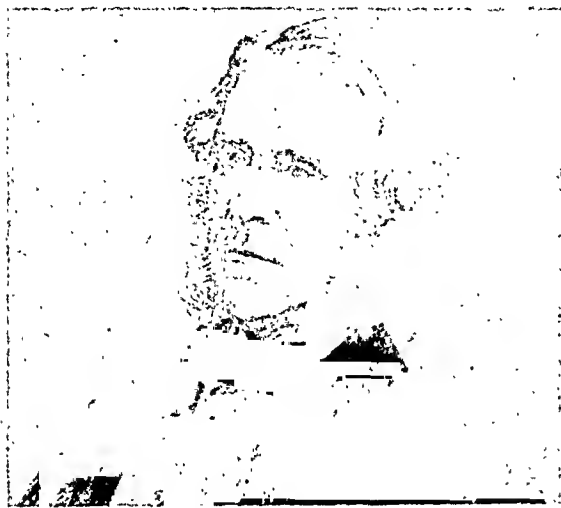


Fig. 2 (Rodin). Robert Christison who was the first to experiment with the Calabar bean.

(Latin) at the University of Edinburgh. He became interested in toxicology, and between 1822 and 1832 held the chair of medical jurisprudence at the University. His reputation as a medical jurist was well established by his famous book, *A Treatise of Poisons*, published in 1829. In 1832, he was transferred to the chair of materia medica, which he held for 45 years. His studies in this field earned him a reputation at least equal to that which he had won in medical jurisprudence. In 1842, he published his famous "dispensatory," giving in great detail the obvious effects that followed the administration of remedies in disease and laboratory classification of them. As chairman of the Committee of the General Medical Council, he helped to harmonize the pharmacopoeias of England, Scotland, and Ireland into a National Codex.

Christison was twice president of the

Royal College of Physicians in Edinburgh and was also elected president of the Royal Society of Edinburgh. A baronetcy was conferred upon him in 1871. He became a famous practitioner, with one of the largest and most lucrative practices in Scotland. He died in 1882. Among the many honorary appointments bestowed upon him were member of the Pharmaceutical College of New York, member of the American Philosophical Society, and associate of the American College of Surgeons of Philadelphia.

Christison's interest in the Calabar bean was aroused when a missionary sent him one which two of his colleagues cultivated for him. He not only tried the seed on animals, but ate some of it himself. His description of his experience is so animated and charming, and portrays so vividly the character of the experimenter, that I shall let him speak for himself.

Having ascertained the mode of death from the action of the ordeal-bean, I did not consider it advisable to study further the details of its action by means of experiments on animals, because I had been fully informed as to this in a more precise manner by an experiment made with the bean in my own person. I shall conclude this notice with an account of what I experienced; and I trust the details will not appear needlessly minute, as they seem to me to establish an action of a very singular kind in the case of this poison, and one of which we might discover other instances among known poisons, had we equally precise opportunities of determining the true phenomena.

Having some doubts whether I had obtained the true ordeal-poison, as it tasted so like an eatable leguminous seed, I ate one evening the eighth part of a seed, or six grains, about an hour after a very scanty supper. During an hour that I passed in bed reading, I could still observe no effect whatever, and next morning I could still observe none. I am now satisfied, however, that a certain pleasant feeling of slight numbness in the limbs, like that which precedes the sleep caused by opium or morphia, and which I remarked when awake for a minute twice or thrice during the night, must have been owing to the poison.

On getting up in the morning I carefully chewed and swallowed twice as much, viz., the fourth of a seed, which originally weighed

forty-eight grains. A slight giddiness, which occurred in fifteen minutes, was ascribed to the force of the imagination; and I proceeded to take a warm shower bath; which process, with the subsequent scrubbing, might take up five or six minutes more. The giddiness was then very decided, and was attended with the peculiar, indescribable torpidity over the whole frame which attends the action of opium and Indian hemp in medicinal doses. Being now quite satisfied that I had got hold of a very energetic poison, I took immediate means for getting quit of it, by swallowing the shaving water I had just been using, by which the stomach was effectually emptied. Nevertheless I presently became so giddy, weak, and faint, that I was glad to lie down supine in bed. The faintness continuing great, but without any uneasy feeling, I rung for my son, told him distinctly my state, the cause, and my remedy—that I had no feeling of alarm, but that for his satisfaction he had better send for a medical friend. Dr. Simpson, who was the nearest, reached me in a few minutes, within forty minutes after I ate the seed, and found me very prostrate and pale, the heart and pulse extremely feeble and tumultuously irregular; my condition altogether very like that induced by profuse flooding after delivery; but my mental faculties quite entire, and my only sensation that of extreme faintness, not, however, unpleasant. Dr. Simpson judged it right to proceed at once for Dr. Douglas MacLagen as a toxicological authority, and returned with him in a very few minutes.

In his absence, feeling sick, I tried to raise myself on my elbow to vomit, but failed. I made a second more vigorous effort, but scarcely moved. At once it struck me—"this is not debility, but volition is inoperative." In a third effort I was more nearly successful; and in the fourth, a resolute exercise of the will, I did succeed. But I could not vomit. The abdominal muscles acted too feebly; nor were they much aided by a voluntary effort to make them act. I then gave up the attempt, and fell back, comforting myself with the reflection that vomiting was unnecessary, as the stomach had been thoroughly cleared. At the same time the sickness ceased, and it never returned. There were now slight twitches across the pectoral muscles. I also felt a sluggishness of articulation, and, to avoid any show of this, made a strong effort of the will to speak slowly and firmly, through fear of alarming my son, who was alone with me.

Dr. MacLagen, on his arrival, thought my state very like the effects of an overdose of aconite. Like Dr. Simpson, he found the pulse and action of the heart very feeble, frequent, and most irregular, the countenance very pale, the prostration great, the mental faculties unimpaired, unless perhaps it might be that I felt no alarm where my friends saw some reason for it. I had,

in fact, no uneasy feeling of any kind, no pain, no numbness, no prickling, not even any sense of suffering from the great faintness of the heart's action; and as for alarm, though conscious I had got more than I had counted on, I could also calculate, that, if six grains had no effect, twelve could not be deadly, when the stomach had been so well cleared out.

Presently my limbs became chill, with a vague feeling of discomfort. But warmth to the feet relieved this, and a sinapism over the whole abdomen was peculiarly grateful when it began to act. Soon afterwards the pulse improved in volume, but not in regularity. I was now able to turn in bed; and happening to get upon the left side, my attention was, for the first time, directed to the extremely tumultuous action of the heart, which compelled me to turn again on the back, to escape the strange sensation. Two hours after the poison was swallowed, I became drowsy, and slept for two hours more; but the mind was so active all the while, that I was not conscious of having been asleep. On awaking, the tumultuous action of the heart continued. In an hour more, however, I took a cup of strong coffee; after which I speedily felt an undefinable change within me, and on examining the condition of the heart, I found it had become perfectly and permanently regular.

For the rest of the forenoon I felt too weak to care to leave my bed; and on getting up, after a tolerable dinner, I was so giddy as to be glad to betake myself to the sofa for the evening. Next morning, after a sound sleep, I was quite well.

It is interesting that, while Christison was under the effect of the drug, he did not notice its action on the eye.

Typical of the old professors of Edinburgh, who were not only scientists and teachers but philosophers as well, Christison made the following observations concerning the possible use of the Calabar bean for the execution of criminals.

Let me advert lastly to a peculiarity in the action of the ordeal-bean which struck me forcibly while labouring under it. Philosophers have thought it not unworthy of inquiry, how in criminal executions death may be completed without physical suffering to the criminal. Governments have even consulted science on the subject. But science has not yet satisfactorily solved the question. Meanwhile, I suspect it has been accidentally solved by the negroes of Old Calabar. At least, so far as the effects of their state-poison on myself went, there was no bodily uneasiness except the single attack of sickness—apparently the relics of the action of my pe-

cular emetic—but simply a sense of sinking vitality, with clearness of mind, and without any sensation deserving in the slightest degree to be called physical distress. We know, indeed, that many forms of extreme fainting, of which this is evidently one, are attended with feelings, which if not positively pleasurable, are certainly quite unalloyed to pain. Death by simple fainting, without any preparatory painful process, is evidently what a humane execution should aim at producing. And all this, I apprehend, will be effected by the Calabar Ordeal-bean.

Thomas R. Fraser¹ (fig. 3), who had been Christison's assistant, continued this



Fig. 3 (Rodin). Thomas R. Fraser, the first to isolate the active principle, physostigmine.

study, and in his graduation thesis, in 1862, discussed the action of the Calabar bean.

In 1863, he separated from the kernel (the spermoderm of the bean) and later from the excrement of a lepidopterous insect which feeds on the kernel, an amorphous active principle with the properties of a vegetable alkaloid. He proposed the name Eserina for this alkaloid derived from Esère, as the ordeal poison is called in Calabar. Some time later, he obtained a

purier, crystalline form of the alkaloid, which he called Eseria.

Fraser was one of the Big Five (Sir Douglas MacLagan, Sir Thomas Grainer Stewart, Sir Alexander Simpson, Professor Greenfield) who gave greatness to medicine at the University of Edinburgh in the second half of the 19th century. All of them practiced clinical medicine and, at the same time, held chairs in a single specialty at the University. Under their leadership, the university teaching of medicine progressed to brilliant heights.

Fraser, born at Calcutta in 1841, died at 79 years of age. He was educated at the public schools in Scotland and at the University of Edinburgh, where he received a gold medal for his thesis on the Calabar bean. When Christison resigned, Fraser was appointed to his chair in pharmacology. Many honors were bestowed upon him. In 1903, he was knighted by King Edward VII.

After the publication of his work on Calabar bean, his research led to the study of other ordeal and arrow poisons. His best known contribution deals with *Strophanthus* and *Acocanthera*. Following his investigation of Calabar bean, he became interested in the subject of antagonism in general, and in that of physostigmine and atropine in particular. He regarded pharmacology as one of the means by which the healing of disease could be reached. He substituted for old methods in which the effects of drugs were studied through their administration in disease, a newer science in which, after the essential nature of the pathologic process had been defined, accurate biologic and chemical knowledge was employed to produce the substance that should influence the perverted process. This application of pharmacologic knowledge to the cure of disease, a problem entirely separate from determining the action of remedies, was illustrated by his

earliest work in connection with physostigmine, its relation to atropine, and the uses of these two drugs in ophthalmic practice.

Fraser was first to observe contraction of the pupil associated with the use of physostigmine (fig. 4). He reported that the pupil contracts within a few minutes after physostigmine is applied to the eyeball, to the cutaneous surface in its neighborhood, or to the nasal mucous membrane. He found that application of Calabar-bean extract to the eyeball produces a somewhat painful sensation of tension in the ciliary region, contraction of the pupil, myopia, and astigmatism.

Fraser described the action of physostigmine on his own eye. He placed a small drop of the syrupy solution on the conjunctiva of the left eyeball. There was instantaneous copious discharge of tears. In five minutes, the pupil of the left eye was contracted to half the size of the right. In 10 minutes, the pupil was one-sixteenth-inch in diameter. Vision became imperfect, but the eye was mobile. There was a slightly painful sensation in the supraorbital region and a feeling of heat in the left eyeball. In 30 minutes, no change was observed in the pupil of the right eye, whereas that of the left eye was pinpoint in size.

Fraser noticed that vision of the left eye was greatly reduced. The eye was somewhat red and tender when exposed to light. In $1\frac{1}{2}$ hours, all disagreeable sensations had disappeared, dimness of vision was less marked, but the pupil remained contracted. In four hours, vision had returned to normal, but the pupil re-

With the Author's compliments.

ON THE
PHYSIOLOGICAL ACTION OF THE CALABAR BEAN
(PHYSOSTIGMA VENENOSUM, BAILEY).

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TRANSACTIONS OF THE ROYAL SOCIETY OF EDINBURGH, VOL. XXIV

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MCCCLXXVII.

Fig. 4 (Rodin). Title page of Fraser's thesis, "On the Physiological Action of the Calabar Bean," reprinted from the Transactions of the Royal Society of Edinburgh.

mained contracted for 24 hours. After this it slowly dilated, and five days later had returned to normal.

Douglas Argyll Robertson (fig. 5), a practicing ophthalmologist, also experimented with the use of the drug and observed its action on the pupil. He was born in 1837, the son of a surgeon and

lecturer in the Edinburgh Medical School. He studied in Berlin under von Graefe. Upon returning to Edinburgh, he soon gained recognition as an ophthalmic sur-



Fig. 5 (Rodin). Douglas Argyll Robertson, the first to study carefully the action of eserine on the pupil.

geon, and was one of the founders of the Eye Dispensary. His present fame rests on his description, in 1869, of the Argyll Robertson pupil.

While practicing, Argyll Robertson conducted the first class in practical physiology at the University of Edinburgh. He was interested and well informed in all departments of medicine, and his choice of subject before the Ophthalmological Society of the United Kingdom in 1893, "Therapeutic Contributions of Ophthalmology to General Medicine," was characteristic of the man. He was appointed first assistant, then ophthalmic surgeon at the Infirmary. He was the first surgeon not residing in London to be elected president of the Ophthalmological Society of the United Kingdom.

A singularly attractive and gifted indi-

vidual, he was one who would have come to the front in any walk of life. He had distinguished bearing, courage, and sincerity. As a surgeon, he was neat, rapid, and resourceful. He was also an excellent teacher.

Argyll Robertson had been interested in the discovery of a substance which, when applied to the conjunctiva, would produce an effect exactly opposite to that of belladonna; one which would stimulate the muscle of accommodation and the sphincter pupillae as atropine paralyzes them. He tried various drugs without satisfactory results. When Fraser in-

With The Author's Consent,

THE

CALABAR BEAN

A NEW AGENT IN OPHTHALMIC MEDICINE.

BY

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READ BEFORE THE EDINBURGH MEDICO-CHIRURGICAL SOCIETY, 4TH FEBRUARY 1893.

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MCCCLXIII.

Fig. 6 (Rodin). Title page of Fraser's reprint of his article, "The Calabar Bean as a New Agent in Ophthalmic Medicine."

formed him that he had seen contraction of the pupil result from local application of Calabar-bean extract, Argyll Robertson used it on his own eyes⁶ (fig. 6).

He noticed that the substance contracts the pupil and affects accommodation, causing indistinct vision of distant objects. He also observed that accommodation is first to return, before the pupil resumes normal size. Further, he instilled Calabar-bean extract followed by a drop of atropine. His experiments led him to believe that physostigmine and belladonna were antagonistic in their action on the eye.

Argyll Robertson did not realize the value of Calabar-bean extract as a miotic in glaucoma, but did suggest that it be applied after atropine preparatory to examination of the eyes. He also proposed its use for the relief of photophobia and paralysis of the ciliary muscle. Moreover, he believed it to be beneficial in cases of ulceration of the margin of the cornea leading to perforation, and even when prolapse of the iris had occurred.

Publication of the works of Fraser and Argyll Robertson incited great interest in the use of Calabar-bean extract for affections of the eye. One of the papers read at the first meeting of the American Ophthalmological Society, in 1864, by Dix of Boston, concerned the effect of Calabar-bean extract upon paralysis of accommodation following diphtheria.

Ludwig Laqueur⁷ (fig. 7) was the first ophthalmologist (March, 1875) to use physostigmine therapeutically in glaucoma. He noticed that it lowered intraocular pressure temporarily or permanently.

There was strong opposition to eserine when it was first used to treat glaucoma. Laqueur maintained his stand courageously in the face of resistance. He was fortunate to have as a supporter the veteran Snellen.⁸

Laqueur mentioned that Calabar-bean extract occasionally raises intraocular pressure, but not as much as atropine. Adamük also observed a slight rise in intraocular pressure after local application of Calabar-bean extract. This finally was contradicted by Adamük, von Hippel, and Grünhagen.⁹

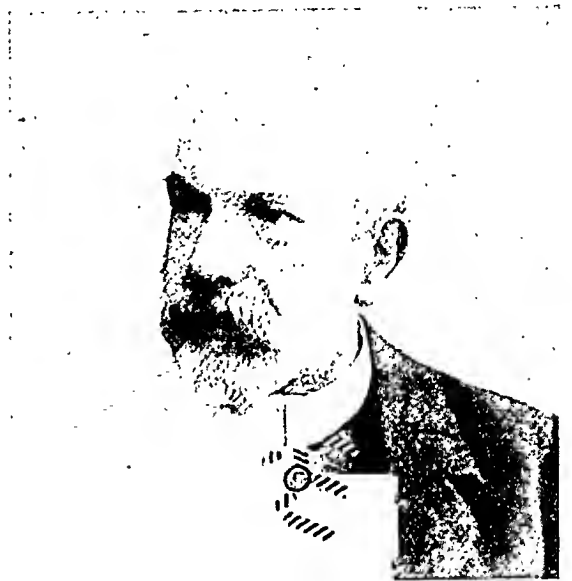


Fig. 7 (Rodin). Ludwig Laqueur, who introduced the use of eserine in glaucoma.

Laqueur used the extract in treating more than 10 cases of advanced glaucoma simplex. The effect was not identical in every case; but reduction in tension was constant. After three or four days, often at the end of 24 hours, the effect disappeared. In other cases, reduced tension was more lasting, and a cumulative effect of reduced tension to subnormal for a considerable period was obtained. He noted that improvement in vision in glaucoma simplex did not occur, but that in many cases there was increase in the visual fields. To his credit, he felt that the series of cases was too small for him to make conclusions concerning the value of the drug in glaucoma simplex. He also used physostigmine successfully in three cases of subsiding glaucoma. These were mildly subacute cases, and reacted

promptly and definitely to physostigmine over a protracted period. He reported three cases of acute glaucoma and one of possible secondary glaucoma which were benefited by the use of physostigmine.

Laqueur makes the statement that physostigmine has a favorable effect, but that it does not supplant iridectomy; it acts only as an adjunct to surgery by making the technique easier.

Von Graefe¹⁰ also experimented with the Calabar bean, which he used to facilitate iridectomy, because the miotic effect facilitated the technique of operation.

From that time on, eserine has been used more and more extensively, and now it occupies a prominent place in the treatment of glaucoma.

490 Post Street (2).

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EVALUATION OF THE NEWER THERAPEUTIC AGENTS IN OPHTHALMOLOGY*

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Modern civilization calls for new and better products, and medicine, to keep step, must find newer methods of therapy which produce complete cures in a shorter period of time. Chemotherapy, because of the rapidity of its therapeutic effect, certainly called attention to the fact that modern medical therapeutics is almost as spectacular as radar and the atomic bomb. Pages are being written on the experimental and clinical application and results of sulfonamide and penicillin therapy.

As a result of present day enthusiasm for things new and modern, there is a tendency to overlook the all-potent therapeutic ability of Nature to heal the ailments of the living world, and it follows that this same Nature has tremendous ophthalmo-therapeutic powers. Walter Stanley Haines, who has probably been forgotten except for his Haines solution, applied a great deal of philosophy and good common sense to his teachings, and his definition of a "good doctor," given to the young medical student, contained the admonition that a "good doctor" never did anything which would hinder Nature in her attempt to effect a cure, and he cautioned the doctor "always to consider treatment as an aid to Nature's curative powers."

For a time, it seemed that the sulfonamides and penicillin would produce a revolution in modern therapeutics, but after time and experience had mellowed the initial enthusiasm, it became quite

evident that, although we were indeed more than fortunate to have these substances available to us, there were diseases which did not respond to their administration. It became necessary to evaluate these drugs properly, and to recognize, very early, those cases which would be most benefited by the use of chemotherapy. Sulfonamides and penicillin must not be used indiscriminately, particularly for minor infections. In ophthalmology, the usually accepted local therapy must still be faithfully carried out in the majority of instances.

If possible, a bacteriologic study should be made to determine whether or not the infection present is due to an organism which is susceptible to the action of these drugs. Every one realizes it is difficult to obtain a culture in the case of many external ocular infections, and, in these instances, chemotherapy will probably be instituted in spite of negative bacterial cultures.

SULFONAMIDE THERAPY

Contradictory reports on the value of the sulfonamides have been made by men of equal repute, and it is sometimes difficult to evaluate the pros and cons in the literature. Isolated case reports show miraculous cures, but some report failures. Through this dissemination of knowledge and experience, we are constantly learning more and more about the uses of the sulfonamides, and the final chapter remains to be written. Newer drugs of this group are still being discovered, and the clinical ophthalmologists, who greatly outnumber those in the research group, must be able to evaluate the information supplied in the literature, and

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apply the same to everyday usefulness.

Penicillin is now frequently replacing the sulfonamides and has proved far superior in some instances. However, the ophthalmologist will still find much value in the use of sulfa both locally and orally. It appears that the sulfa ointments will replace yellow oxide in popularity. There is a tendency to use chemotherapy routinely for any infection, and, because of this tendency, some hospital records are of no value for statistical purposes. Single-dose chemotherapy, as ordinarily used, is valueless, except to impress the patient or his relatives with the fact that he has been given the latest drug which the public press is popularizing.

It must be remembered that the sulfonamides are merely bacteriostatic, and, when administered either orally or locally, they must be given in high enough doses and over a sufficient period of time to obtain not only an improvement, but a permanent cure.

Before sulfonamides are given orally, it is important that the urine and blood counts are normal and, during administration of the drug, the blood level must be maintained between 5 to 10 mg. per 100 c.c. Repeated urinalyses and blood counts must be made; alkalinity of blood and urine¹ must be maintained; high intakes of liquids are necessary; and accurate temperature recordings are required. Sunlight should be avoided to prevent possible cutaneous reactions on the basis of a photosensitization.

It behooves us to know that there are severe toxic manifestations in sensitive individuals, not only generalized but ocular as well, and toxic reactions occur after either oral administration or local application. Consequently, it is important to repeat that the sulfonamides should not be used indiscriminately for minor infections which do not warrant the risk of toxic reactions, although the

recent products are less toxic than the original ones. It has been our experience that systemic and local reactions are much more frequent than one would deduce from a perusal of the ophthalmic literature.

The possible toxic reactions which may be encountered are anemia, neutropenia, cyanosis, low white count, hyperpyrexia, severe gastroenteritis, neuritis, psychosis, renal calculi, kidney damage with anuria and hematuria, and dermatoses. A sore throat may indicate a beginning agranulocytosis. Ocular manifestations of oral medication have been variously reported as optic neuritis, retinal hemorrhages, "dimness of vision," "temporary blindness," field changes, conjunctival and scleral injection, yellow discoloration of sclera, a bluish tinge indicating cyanosis or anemia of the conjunctiva, and transient myopia.

Local application of sulfonamide ointment and solution has frequently produced marked irritation of the cornea and conjunctiva with redness and swelling of the lids. It causes delay in the healing and increases the vascularization and scar formation of the denuded or injured cornea. We must also realize that, although toxic phenomena may not immediately occur, an appreciable number of patients become sensitized to the drug and display toxic effects during subsequent administration. In any case, stopping the administration of the drug usually results in rapid recovery.

If the ophthalmologist realizes all these exceedingly important factors and carefully evaluates his cases, he is prepared to proceed with sulfonamide therapy toward the goal of obtaining maximum benefits and excellent results in the majority of cases for which these drugs are so aptly suited; but, he must bear in mind that atropine, heat, surgery, and all the other specific therapeutic procedures indicated,

must be carried out in conjunction with sulfonamide therapy.

Orally, the most effective sulfonamide is sulfadiazine in average doses of 1 gm. every four hours after an initial dose of 2 to 4 gm.; and locally, sulfathiazole as a 5- to 10-percent ointment or 1- to 10-percent sodium-salt solution, and either method alone, or together, may be indicated. Several foreign authors² recommend a 15-percent sodium-sulfacetamide collyrium.

The ophthalmic conditions which are favorably affected are: trachoma, inclusion-body blennorrhea, catarrhal conjunctivitis, staphylococcus, gonococcus, influenza-bacillus, colon-bacillus, and actinomyces infections, erysipelas, serpent ulcers, cellulitis of lids and orbit, dacryocystitis, endophthalmitis, panophthalmitis, and occasionally sympathetic ophthalmia.

As previously stated, penicillin is supplanting the sulfonamides in some types of infection, and especially is this true in gonorrheal ophthalmia, blepharitis, catarrhal conjunctivitis, and dacryocystitis. Nevertheless, penicillin may not be readily available; or full-strength, fresh solutions may not be practicable.

In blepharitis we have had the best results by rubbing the sulfathiazole ointment into the roots of the lashes. It usually acts most rapidly but, unless continued for sufficient periods of time, recurrences result. If recurrences do occur, staphylococcus toxoid used in conjunction with the sulfa ointment produces excellent results. If trichiasis should be present, the lashes must be epilated; and if the meibomian glands are involved, they must be mechanically expressed. Nor will sulfathiazole used locally cure a chalazion or hordeolum. In the presence of secretions or debris, the bacteriostatic action is inhibited.

The preponderance of evidence indicates that the sulfonamides are curative or

of great value in the treatment of trachoma, but there are a few leading authorities who believe that these drugs are ineffective.³ However, the sulfonamides, orally and locally, must be included in the treatment of trachoma,⁴⁻⁵ and other types of therapy will still be indicated in those cases in which sulfa therapy either fails to act or where a sensitivity to the drug exists.

In the case of inclusion-body blennorrhea, irrigation with a sodium-sulfathiazole solution every two hours, sulfa ointment at night, and sulfadiazine by mouth, produce excellent and very rapid improvement within seven to ten days as compared to six weeks with the previous types of therapy.

Similarly, the prolonged severe inflammation, with poor response to previous types of therapy which was encountered in the cases of membranous conjunctivitis, has been eliminated by the local use of the sulfonamides.

Catarrhal conjunctivitis responds very rapidly to the local use of the sulfa—both ointment and solution—but, in the presence of purulent discharges or anesthetics, the action is inhibited.

Excellent results are obtained in ulceration of the cornea, but here, as well as in traumatic destruction of the epithelium, results are obtained only when superimposed infection exists. The sulfonamides delay the healing of corneal ulcers⁶ and produce an increase in the amount of scar formation in a denuded or injured cornea and should not be used except in the presence of a superimposed infection.

It was most interesting to analyze the statistics of Smith⁷ of the Royal Hospital, Sheffield, in reference to hypopyon ulcers, for the years 1936 through 1944. The admission of patients with spontaneous ulcers averaged 24 per year, and those with traumatic ulcers 53 per year—39 with hypopyon and 14 less severe. Py-

rexial and local treatment remained essentially the same during this nine-year period, but in July, 1939, the treatment was combined with the internal administration of sulfanilamide, changing to other sulfonamides as these became popular. The average number of days hospitalization for the period 1936 through 1939 was: hypopyon ulcer, 19.6 days, and less severe ulcers, 13.0 days. Then there occurred a definite decrease in necessary hospitalization with the average in 1944 being: hypopyon ulcer, 12.5 days, and less severe ulcers, 7.5 days.

Since a high concentration of these drugs appears essential to an effective therapeutic result, the local use seems to be preferred over the systemic use. In cases of inclusion blennorrhoea, trachoma, and serpent ulcer, however, it has been proved that both oral and local administrations are required. There does occur some penetration of these drugs into the anterior chamber, but to induce this penetration it is necessary to utilize heat, paracentesis, wetting agents, and so forth.

In cases of cellulitis of the lids and orbit, endophthalmitis, and panophthalmitis, excellent results have been obtained through oral administration of large doses. However, the administration must be started very early, and continued for several days after complete recovery has occurred; and then, gradual reduction, rather than abrupt cessation of the drug, is to be preferred. If abscess formation occurs, it is absolutely necessary to incise and drain; otherwise, the suppurative material will not be absorbed.

Since the sulfonamides have been used so extensively for the treatment of meningococcic meningitis and scarlet fever, there has resulted a marked decrease in the number and severity of the complications. We are now aware of one to two cases per year of endophthalmitis as compared with eight to ten such complica-

tions only a few years ago. The same decrease in incidence applies to orbital abscesses and acute suppurative dacryocystitis. Sulfonamides not only cure the systemic infection swiftly but, in so doing, also prevent the serious complications. It is recalled that in several cases of complications, sulfa was not administered immediately but was withheld, pending diagnosis. This situation brings up the point that possibly, in these cases, the complications had already begun before the sulfonamide blood level was of sufficient concentration to control the bacterial activity. A reduction in the number of complications has also been noted in other instances besides ophthalmic; for example, the decrease in the incidence of mastoiditis, following middle-ear infections. We are prompted to repeat again, that in order to obtain satisfactory results, sulfonamide therapy must be begun early, given in high enough doses, and for a sufficient length of time.

Gamble⁸ reported the successful control of a case of sympathetic ophthalmia with sulfa, and since then he has had similar experiences with several other cases. I have had the privilege of following two of these cases. The most recent one, which is of about five months' duration and which is still under observation, develops periodic episodes of mild ciliary injection, without cells in the anterior chamber. In this case, an extensive dermatosis with hyperpyrexia developed, with immediate recovery when the drug was discontinued. This case will be referred to later.

Several other cases have been reported⁹ with control of the sympathetic ophthalmia, but some cases have also been reported as failures. Nevertheless, in this most dreadful of ophthalmic afflictions, sulfathiazole should be administered as soon as possible and in large doses.

There is a consensus of opinion that

sulfa is very beneficial as a prophylactic after intraocular injuries or after operations with threatened infection. Our experience would confirm this opinion, and no postoperative infections have occurred during the routine use of 5-percent sulfathiazole ointment, locally, or oral administration of sulfathiazole when indicated.

We have found the sulfonamides of little, if any, value in uveitis. An occasional report has been made purporting to have produced good results, but a perusal of the case reports leads us to be skeptical of the published conclusions. Many cases of uveitis regress under conservative treatment; whereas, others terminate unfortunately in spite of everything one may do. One has only to consider the vast number of quiescent lesions which are seen on routine ophthalmoscopic examination to appreciate that many cases of both anterior and posterior uveitis recover without any treatment, and without apparent knowledge of their existence by the patient. This is especially true of choroiditis.

In 1942, Levy and Lewis¹⁰ reported the successful use of the sulfonamides in 137 cases of gonorrheal conjunctivitis, and advocated both systemic and local applications, because results with local therapy alone did not compare favorably with the internal use of the drug. Successful reports^{11,12,20} have also been published in relation to ophthalmia neonatorum, but in both of these instances we believe that the sulfonamides will be completely eclipsed by the miraculous results of penicillin therapy. There seems to be no justification in subjecting a two-weeks-old baby to oral sulfonamide.

PENICILLIN

Whereas the sulfonamides are merely bacteriostatic, penicillin actually kills organisms, and it is probably because of this ability that the latter is gradually re-

placing the former in ocular therapeutics.

Penicillin may be administered systemically or locally or both, and is also used locally in conjunction with the oral administration of the sulfonamides. Like the sulfonamides, penicillin can be administered intramuscularly or intravenously, but it cannot be given orally in simple solution because the acid gastric juice destroys its action. When applied locally, any acid substance like boric acid or the adrenalin hydrochloride¹³ will inhibit the action of penicillin. It cannot be regarded as a nontoxic substance or a readily diffusible one.

Last April a report¹⁴ was published describing the oral use of penicillin in conjunction with aluminum dihydroxy-amino acetate. Eleven cases of external disease and four cases of uveitis were reported. Rapid cures were obtained in the majority of cases, but three cases of external infections and the four cases of uveitis failed to respond.

Generally speaking, Gram-positive organisms are sensitive, and Gram-negative ones are insensitive; staphylococcus aureus, streptococcus pyogenes, the gonococcus, and the meningococcus are sensitive; the pneumococcus is only moderately or slightly sensitive, according to type; the hemophilic group is relatively insensitive, but all insensitive organisms seem to respond to very strong concentrations of penicillin; and the sensitivity varies widely with different strains of the same organism. Acquired resistance frequently occurs. The only incompatibility is the acid radical; and, very fortunately, the common ophthalmic drugs—atropine, eserine, cocaine, argyrol, fluorescein, and so forth—can be used in conjunction with penicillin.

Penicillin has no effect on body tissues; there is no inhibiting effect on leukocytes; it is less lethal than the sulfonamides; secretion and debris do not inhibit its ac-

tivity; on the other hand, it seems that the more pus and organisms present, the more striking is the effect of the penicillin.

Toxic manifestations,¹⁵ local and systemic, are encountered in the use of penicillin, and have been variously reported as chills, fever, headaches, eosinophilia, urticaria, thrombophlebitis, gastrointestinal reactions, serum sickness¹⁶ of varying degree, contact, vesicular, and bullous dermatitis, swelling of the conjunctiva and eyelids.¹⁷ However, these reactions are not as frequent nor as severe as those associated with the use of the sulfonamides, and promptly disappear when the administration of the drug is discontinued.

In cases of episcleritis, phlyctenular keratitis, marginal ulcerations, herpetic keratitis, and corneal ulcerations in general, penicillin has no value unless there is an associated infection with a susceptible organism. It is not too effective when administered intramuscularly in the case of deep ocular infections due to the difficulty in obtaining sufficient concentration in the ocular tissues, and to the inability of the penicillin to penetrate into the intraocular spaces. It is best used early before deep infections occur but, with the advance of time, intraocular injections will become feasible.

Very recently, Stokes and others,¹⁸ after a very exhaustive study of the use of penicillin injections for neurosyphilis, stated that "the results in primary optic atrophy are as yet inconclusive."

When used locally, penicillin must be kept in constant contact with the tissues either by way of the ointment, frequent instillations of the aqueous solution, continued corneal baths, or by iontophoresis.

It has been used as a subconjunctival and anterior-chamber injection, with good results if a pure solution was used, but it should be injected in small quantities. Injection into the vitreous of a very pure solution has been advocated with caution.

Penicillin has little, if any, value in choroiditis of unknown etiology, and one must question the few reports which attempt to show that results have been obtained.

Recently, Ida Mann¹⁹ reported the intraocular use of penicillin in 29 cases of severe infection following injury. Only those cases were chosen in which, from general clinical experience, the prognosis was considered to be hopeless; namely, unless enucleation was performed the pathologic process was expected to continue indefinitely. In these cases, 0.25 c.c. of a solution of 1,000 to 50,000 units was injected into the anterior chamber or vitreous; penicillin ointment was applied locally. The weaker dilutions seemed to give the best results, and the stronger solutions were used only in the most desperate cases. The prognosis was worse, if the lens had been injured. Where the penicillin came in direct contact with the vitreous, the vitreous became opaque, and sight was not regained. In all cases which recovered, there occurred a reactive iritis lasting four days but subsiding suddenly. Apparently, only two injections were necessary, and in all cases where a third injection was deemed necessary, the eyes remained blind.

Of these 29 cases, 11 eyes did not improve and were enucleated. Of the remaining 18 eyes, nine healed and remained quiet and painless, but blind from damage done by the original injury. In three of these, the injection was made into the vitreous, which became opaque and did not clear; one healed with cataract formation; one regained 6/200 vision; one regained 20/100 vision; and the remaining six healed with good results.

In the experimental work on rabbit eyes, which preceded this clinical trial, penicillin injected into the anterior chamber produced a reactive, aseptic, anterior uveitis of varying severity, with 100 per-

cent pure solution producing a minimal reaction. When injected into the vitreous, it produced a most complete neuroretinal degeneration followed by fibrosis, and accompanied by thickening and fibrosis of the choroid. Again, pure penicillin showed minimal and transitory effects, or none at all.

It appears, therefore, that intraocular injections of penicillin, while at present subject to great caution, may ultimately prove of tremendous value in combating intraocular infections. When used locally after operations, or at once in penetrating injuries, penicillin prevents the incurrence of infection, and will readily disinfect the conjunctival sac prior to ocular surgery.

It is important that solutions for topical application be frequently and carefully prepared, and properly refrigerated. It must be frequently applied to maintain concentration. The ointment, 1,000 Oxford units per gram, is admirable because the penicillin retains its activity in high concentration for a longer period of time. As in the case of the sulfonamides, penicillin must be continued for at least 48 hours or more after apparent clinical cure to prevent a relapse.

With the apparatus of MacMillan of the physiotherapy department of the Royal Victoria Hospital, Montreal, iontophoresis²⁰ produces the quickest and most effective penetration of penicillin into the anterior chamber of the eye, and is followed by excellent results in bacterial infections of the anterior segment. However, the apparatus is not readily available, and the technique requires considerable care and attention. A continuous corneal bath or a continuous drip method while the patient is awake, or the method of Wright,²¹ where a pipette is inserted under the inner end of the upper lid while the patient is asleep, are excellent and more simple methods to employ. The subconjunctival injection of penicil-

lin will also result in a penetration of the drug into the anterior chamber. In addition, edema or inflammation of the cornea, cocainization of the cornea, or damage to the corneal epithelium will increase the rate and amount of penetration.²²⁻²⁵

Very little has been written about penicillin control of sympathetic ophthalmia.²⁴ Gamble²⁶ gave his patient, previously mentioned here, large doses of penicillin after he became toxic to the sulfonamides, and five months after the onset of sympathetic symptoms, with no penicillin for the past four months, no cells have been noted in the anterior chamber, and the vision remains normal, although several attacks of ciliary irritation have occurred.

Another case, which I believe responded to penicillin, suffered a laceration of the eyeball with a safety razor blade. Apparently, because of continuous inflammatory reaction for six weeks after injury, an enucleation was performed. Four days later the patient came under my observation. Intuition prompted a daily slitlamp examination. Only an occasional cell was noted in the anterior chamber, but within the next four days the cells increased in such numbers that sulfathiazole was promptly administered. The same evening the patient had severe hyperpyrexia with a rash and acute gastroenteritis. The sulfa was immediately discontinued—followed by prompt relief of the toxic symptoms. The following day the cells increased in number. The patient was given 30,000 units of penicillin intramuscularly every three hours around the clock. The cells in the anterior chamber became very numerous and large deposits formed on the posterior surface of the cornea. Within five days after penicillin therapy was instituted, the cells began to diminish, the deposits gradually decreased in size and number and, after 15 days, no further activity was noted, ophthalmoscopic examination was entirely

negative, and the vision was normal. The penicillin was administered for a total of 21 days. The patient was observed for about two months, was examined one year later, and continued to be free of all symptoms with no recurrences. It would appear that penicillin certainly merits a trial in similar instances. It should be noted that the penicillin was started very early. I might add that the daily slitlamp examinations revealed the activity, prior to any subjective or other objective symptoms, and these were minimal even after they did occur, possibly because of the concurrent penicillin injections.

The clinical evidence for the use of penicillin is overwhelmingly in favor of its local application to the lids and to the conjunctival sac. It is specific for almost all types of infectious conjunctivitis and blepharitis, which respond best to the ointment.

In ophthalmia neonatorum and gonorrheal ophthalmia,³⁰ penicillin acts miraculously in aqueous solution, being advocated in strengths of 200 to 1,000 units per c.c., applied locally. The British²⁷ had suggested its use locally. In 1943, we²⁸ saw a most terrific discharging gonococcal ophthalmia of two weeks' duration. Since penicillin was not readily available to us at the time, we drained the bottoms of several vials and made up a saline solution of 500 units per c.c. and instilled it hourly. When a clinical cure was obtained in 24 hours, it was believed that the solution was too strong, and it was reduced to 250 units per c.c. Our later experience indicated that either 500 or 1,000 units per c.c., made up fresh every few days and kept properly refrigerated, is the solution of choice, with a complete cure to be expected in one or two days.

Sorsby²⁴ advocates the use in infants of one drop at intervals of one minute for a half hour. He says that drops every

hour are good, but every five minutes, better.

When a genital gonorrhea coexists, the intramuscular injections²⁹ will also control the ocular infection; nevertheless, we believe that, in addition, a solution of penicillin should also be instilled locally. However, when there is no other lesion present, except in the conjunctiva, local instillations will suffice, and, under these circumstances, intramuscular injections are not indicated unless the local treatment should happen to fail.

The specificity of penicillin for the gonococcus also brings up the question of a substitute for the present recognized form of Credé prophylaxis, and it is possible that, in the near future, either penicillin solution or ointment may be found more efficacious and less irritating than 1-percent silver nitrate.

We advocate¹⁷ the use of the weaker solution for irrigation of the lacrimal sac in instances of acute suppurative dacryocystitis, and we have found that it will prevent infection when used as irrigation through the puncta after dacryocystorhinostomy.

It must be remembered that in cases of orbital cellulitis, where an abscess develops and presents a fluctuating localization, penicillin injections alone are not sufficient. Proper incision and drainage are absolutely essential, after which penicillin packs or frequent local irrigations through the surgical incision, in addition to the injections, result in rapid recovery.¹⁷

In considering the value of penicillin in ocular therapy, one is aware of an absence of agreement among observers, and discrepancies are reported in the clinical results obtained, but these are probably due to impurities of the products available. As our knowledge of penicillin grows, and when a really pure product

is produced or an effective synthetic product is developed, we can anticipate more certain results and possibly even more rapid and spectacular cures.

This statement can be supplemented by quoting a report by the United States Public Health Service and National Institute of Health:³¹

"Penicillin, as commercially prepared, contained not one but several penicillins, known as G, X, F, and K. Penicillin K has been shown to be of little or no value in syphilis and in certain other infections because, as compared with other penicillins, it is rapidly destroyed in the body. The relative effectiveness of the other penicillins G, X, F has not yet been determined for syphilis or for other infections. . . . The situation as to penicillin is a complicated scientific problem under co-operative study both in laboratories and in clinics."

Recapitulating this discussion we can say that: (1) penicillin is the most effective therapeutic agent for acute superficial bacterial infections of the eye; (2) it has great value as a prophylactic before surgery or after injuries; (3) it is indicated in nonbacterial infections only if secondary bacterial infection is present or threatened; (4) in intraocular infections bacterial in origin, it must be used in frequent and continuous intramuscular injections of high concentration in conjunction with high local concentration.

THE HYPERTHERM

There is nothing new about heat treatment, this form of energy having had therapeutic application since the early days of human existence. Foreign-protein injections, intravenous, subcutaneous, and intramuscularly, may produce fever, and they have been used by everyone in many cases, but here also there are limitations to their application.

Hyperpyrexia has now been modernized in the form of the feverbox or hypertherm; it has been popularized and used extensively in other branches of medicine, and a few ophthalmologists have been sufficiently interested to publish their results with this method.^{33,34,35} The hypertherm was used in a series of 14 cases in which there were pathologic conditions present in 18 eyes. These were not usual nor routine cases. They were cases of a more or less serious nature in which either typhoid vaccine, intravenously, was believed contraindicated, or in which its use had proved unsatisfactory or dangerous because of unfavorable reactions. Other types of injection might have been tried, but the pathologic process was too active to warrant taking a chance with any type of therapy which would show results only after a prolonged period of administration. Except for the usual local treatment, which was carried out in each case, there was nothing else which could be used to stem the active pathologic process. The sulfonamides were disregarded because our previous experience with their use in similar cases was very discouraging.

The ability to keep the body temperature at a desired level, for a specific length of time, is a distinct advantage, and it is believed that these factors play an important role in the therapeutic successes obtained. Except for the discomfort of the treatment itself, there were no unfavorable reactions, either local or systemic. Without exception, those patients who were suffering pain voluntarily stated that the pain disappeared during the fever session. All the usual local treatments such as fomentations, atropine, dionin, and so forth, were continued either during or between sessions.

Stated briefly, patients must be prepared for the hypertherm treatments psychologically and physically.³² The heart,

kidneys, blood, and chest must be relatively normal. The afternoon before the treatment, salt must be given orally and intravenously, plus a cleansing enema; a mild sedative is given both the night before and the next morning, one hour before entering the feverbox. During sessions, the specific gravity of the blood is determined and saline is administered by mouth and intravenously.

The temperature of the treatments varied between 102.5 and 105 degrees. Although Smith³³ recommends 105 degrees for a two-hour period and Knight³⁴ advises 105 degrees for a five-hour period, our observations indicated that better clinical results and better coöperation resulted from a moderate 103-degree fever sustained for a period of four to five hours. It should be stated that it requires from one to two hours to raise the patient's temperature gradually to the desired level. It is during these two hours that the patient is most apprehensive and requires the greatest amount of attention. In our series the fever sessions were repeated every two to five days; two patients receiving 5 treatments each, and two patients receiving 12 treatments each, with an average of 9 treatments per patient. The length, frequency, and severity of the treatment depended upon the pathologic condition present and upon the ability of the patients to withstand the treatment. This entire procedure should be under the supervision of a physician physiotherapist with whom there must be mutual coöperation. I am sure that the success we have had was in no small part due to the genuine interest and coöperation of my colleague, Dr. L. S. Shensa.

The pathologic conditions present in the 18 eyes were classified as: choroiditis, 5; iridocyclitis, 5; uveitis, 4; corneal abscess, 2; and severe interstitial keratitis, 2 eyes, both in the same patient with a positive Kahn reaction but no other evi-

dence of congenital syphilis. The visual results were excellent in 8; good in 4; fair in 3; and poor in 3.

A therapeutic success occurred in all the cases. The pathologic activity ceased, and no further local or systemic treatments were necessary except in the case of a colored patient with bilateral sarcoid uveitis who regained fair vision with marked reduction in the pathologic activity but who, later, suffered a recurrence of the uveitis. The hypertherm treatments were not repeated because we believed that the patient could not tolerate them. The three eyes in which poor vision resulted included one with uveitis and two with corneal abscess. Each of these abscesses involved three fourths of the cornea and, because of imminent perforation in both cases, paracentesis was performed, and the corneal section was opened twice on successive days.

We must consider the possibilities of future recurrences in some of these cases; nevertheless, without this type of therapy, it seems certain that the pathologic activity in these eyes would have continued indefinitely and would have resulted in an enucleation in at least some of the cases; and, certainly, blindness would have resulted in many of the 13 remaining eyes.

Ophthalmologists have given the hypertherm scant attention and, in general, are not aware of the usefulness of this very valuable adjunct to their therapeutic armamentarium. It is, therefore, my desire to bring this form of therapy to your attention and to urge its more frequent use in specific cases.

In conclusion, I would like to state that before long, much that we have said may become obsolete—new drugs and new methods of application will be developed. It was not my desire to give a complete review of the subject, but rather to present a general review of the situation, and to encourage an impartial interpretation

of the information which is being published. Chemotherapy and the hypertherm offer excellent and successful results in certain types of ocular conditions, and they are worthy of a trial in many others.

Therapeutic success depends upon the

doctor's ability to analyze each individual case and to decide, quickly and accurately, which form of therapy will achieve the best results, with relief from suffering and with preservation of vision.

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INFLUENCE OF PENICILLIN ON THE COURSE OF OCULAR LESIONS DUE TO A TOXIC AGENT*

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Penicillin has been shown experimentally^{1,2} and clinically^{3,4} to be an effective local agent in the treatment of corneal infections due to penicillin-susceptible organisms. However, there is little reported evidence in the open literature of the value of local penicillin in the prevention of secondary infection in corneal lesions due to toxic agents. It, therefore, seemed advisable to present some data on the course of an experimental standardized ocular lesion, due to vesicant agents, that was treated with penicillin.

METHOD

Six rabbits were used, and organisms from the corneal surface of both eyes

lowed to close immediately after the application had been made. Each eye was read daily and numerically evaluated by a method previously described.⁶

Twenty-four hours after burning, material for cultures was again taken from the corneal surface, following which penicillin, in dosage of five drops of a solution containing 250 units per c.c., was applied to the right eye, and sterile normal saline, in similar quantity, was applied to the left eye of each rabbit. Such therapy was repeated at 9, 11, 1, 3, 5, and 7 o'clock each day. Cultures were taken of the treated and control eyes every day at 8:45 a.m., so that there was a lull in therapy for 13 hours prior to culturing.

TABLE 1
ONSET OF CORNEAL VASCULARIZATION

		8	9	10	11	12	13	14	15 Days
Treated eyes	O.D	2		1		1	1		1
Controls	O.S	5	1						

of each rabbit were removed with a platinum loop for culture 24 hours before and immediately after burning.[†] Free-base[‡] HN₂ (0.4 mg.) was applied to the superior limbus of each eye from a Mc-Masters microsyringe,⁵ and the lids al-

These eyes were read daily for 21 days. At the end of this time, photographs were taken, and the eyes were enucleated, prepared by celloidin technique, and stained with hemotoxylin and eosin. All eyes were marked so that sections were cut through the most severely involved area of each cornea. Microphotographs were taken of that portion of each corneal section which demonstrated the most histologic change.

* From the Department of Ophthalmology of the University of Pennsylvania Hospital. The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and the University of Pennsylvania.

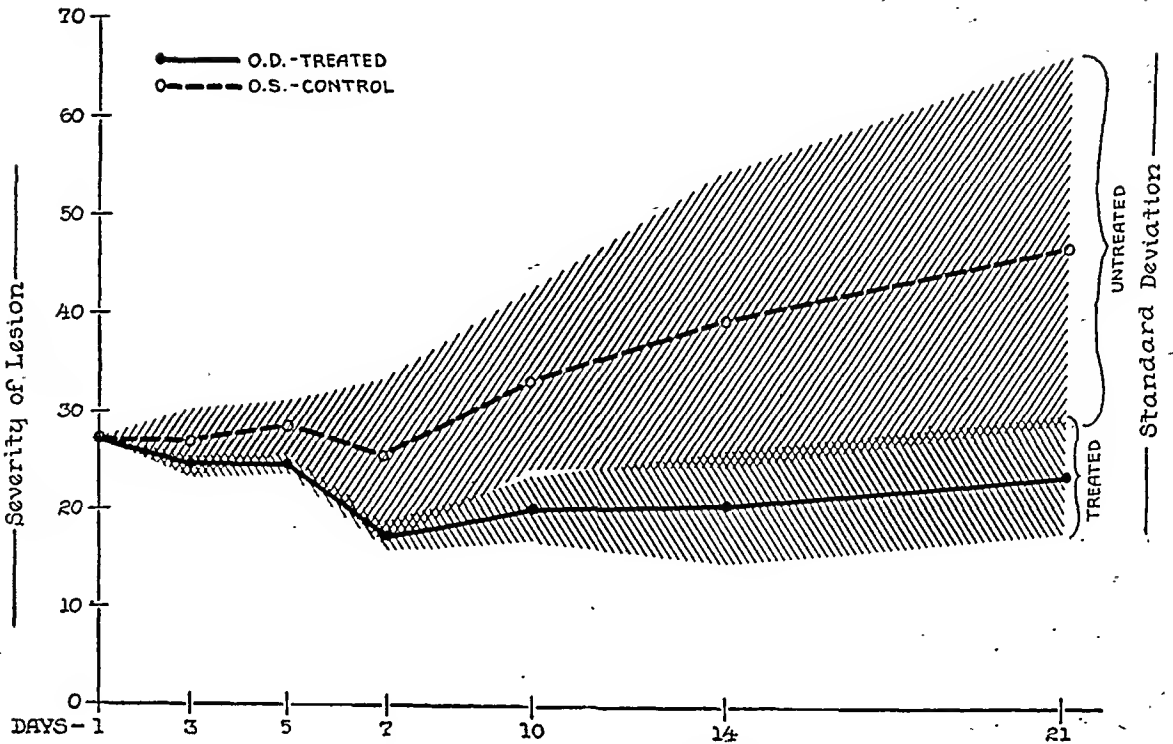
† Cultures were first run on blood-agar plates, aerobically and anaerobically. Differentiation media were used as required. All plates were read at 24- and 48-hour intervals after culturing.

‡ HN₂—a symbol representing a nitrogen mustard (dichlorodiethyl ethylamine).

CLINICAL RESULTS

Clinically, all the eyes treated with penicillin solution showed decidedly less conjunctival discharge, edema, and injection than the control eyes. Four of the

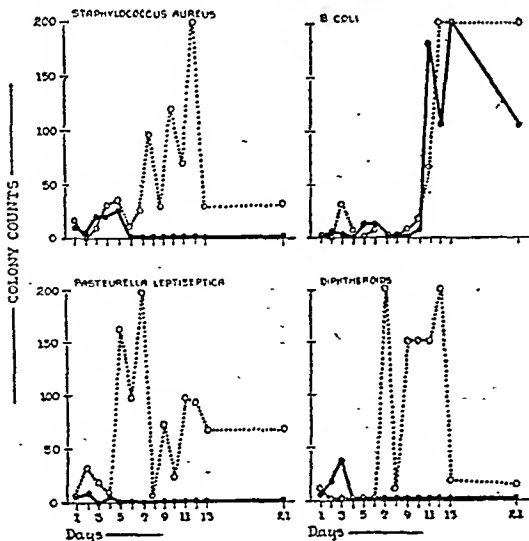
Influence of Locally Applied Penicillin on Course of Ocular Lesions due to Nitrogen Mustard



Graph 1 (Leopold and LaMotte)

Bacterial Flora of Nitrogen Mustard Contaminated Eyes as Influenced by LOCAL PENICILLIN

— Colony counts in treated eyes
— control —



Graph 2 (Leopold and LaMotte)

six treated eyes showed slightly less corneal edema when examined with a bio-microscope and compared to the control. The onset of corneal vascularization was significantly delayed in the treated eyes as is seen in Table 1.

No significant difference could be noted in the rate of corneal epithelial regeneration. By the end of the 21-day period, there was a well-defined inequality in the severity of the total lesion between the treated and the untreated eyes of four rabbits. In two rabbits, the contrast was not significantly evident. When the clinical evaluations are compared through mean and standard deviations and plotted graphically, it is evident that a wide separation of the mean values occurs, but the standard deviations do not quite separate (graph 1).

BACTERIOLOGIC RESULTS

The organisms found were staphylococcus aureus, proteus vulgaris, diphtheroids, bacteria coli, pasteurella leptiseptica, an occasional beta-hemolytic streptococcus, neisseria sicca, and neis-

tually increased in number (graph 2). It was also evident that the growth of organisms, as in mustard ocular lesions, gradually increased and reached a maximum by the end of the first 7 to 10 days after burning. Graph 2 also demonstrates

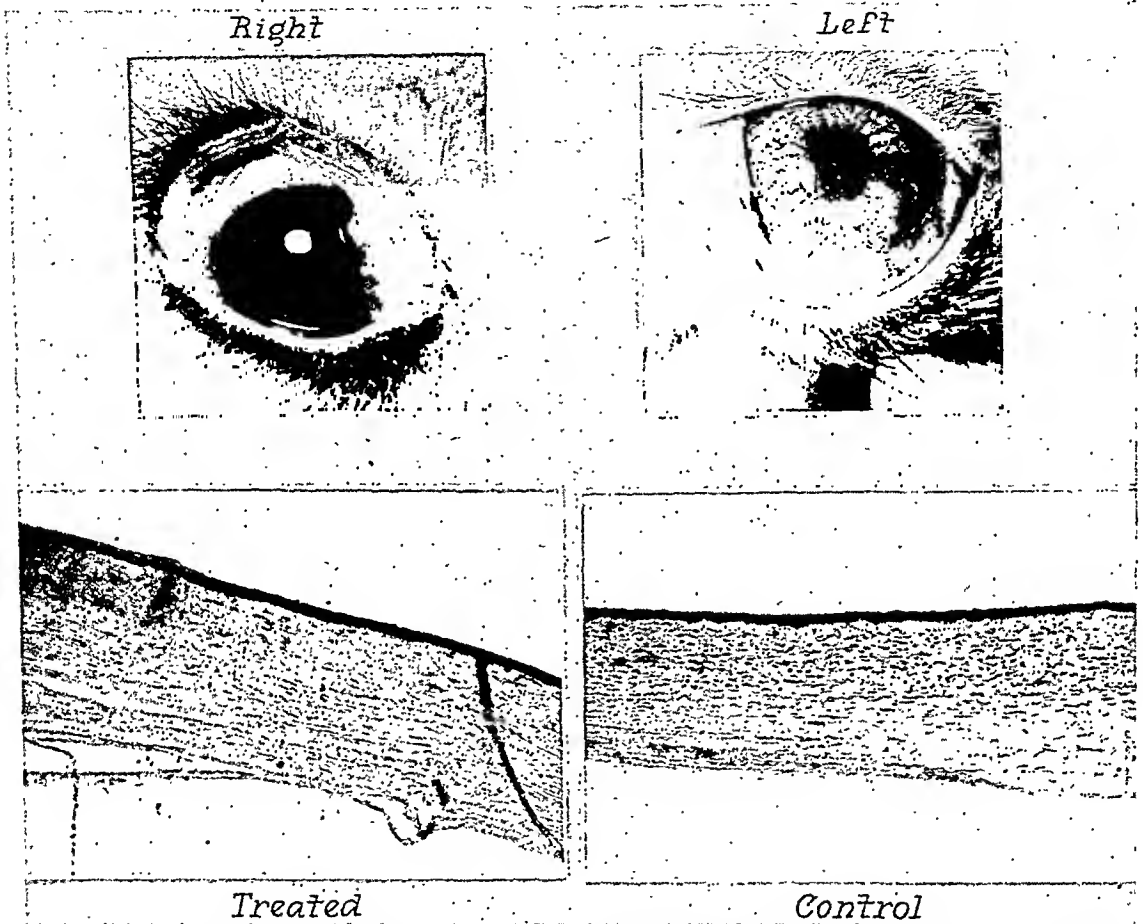


Fig. 1 (Leopold and LaMotte). Clinically the treated right eye shows a clear cornea while the control cornea shows definite haze of lower third. Histologically the control cornea shows slightly greater cellular infiltration.

seria flava. Several observations were fairly evident after a study of the daily colony counts of each organism. It was noted that the nitrogen mustard did not have a significant bactericidal effect on the organisms. Only staphylococcus aureus showed a slight decrease in incidence in the 24 hours after burning. The diphtheroids and the pasteurella organisms ac-

the striking influence of locally applied penicillin on the bacterial contamination of the conjunctival cul-de-sac following nitrogen-mustard burns. In the case of three organisms sensitive to penicillin, the penicillin-treated eyes no longer showed these organisms after three to four days of local therapy. This can easily be seen by examining Graph 2 with particular ref-

erence to the staphylococcus aureus, the pasteurilla leptiseptica, and the diphtheroids; whereas, the organisms not sensitive to penicillin—such as proteus

described.^{7, 8, 9} The eyes of this series do not differ from those previously described except in two details: (1) The treated eyes of four rabbits showed significantly

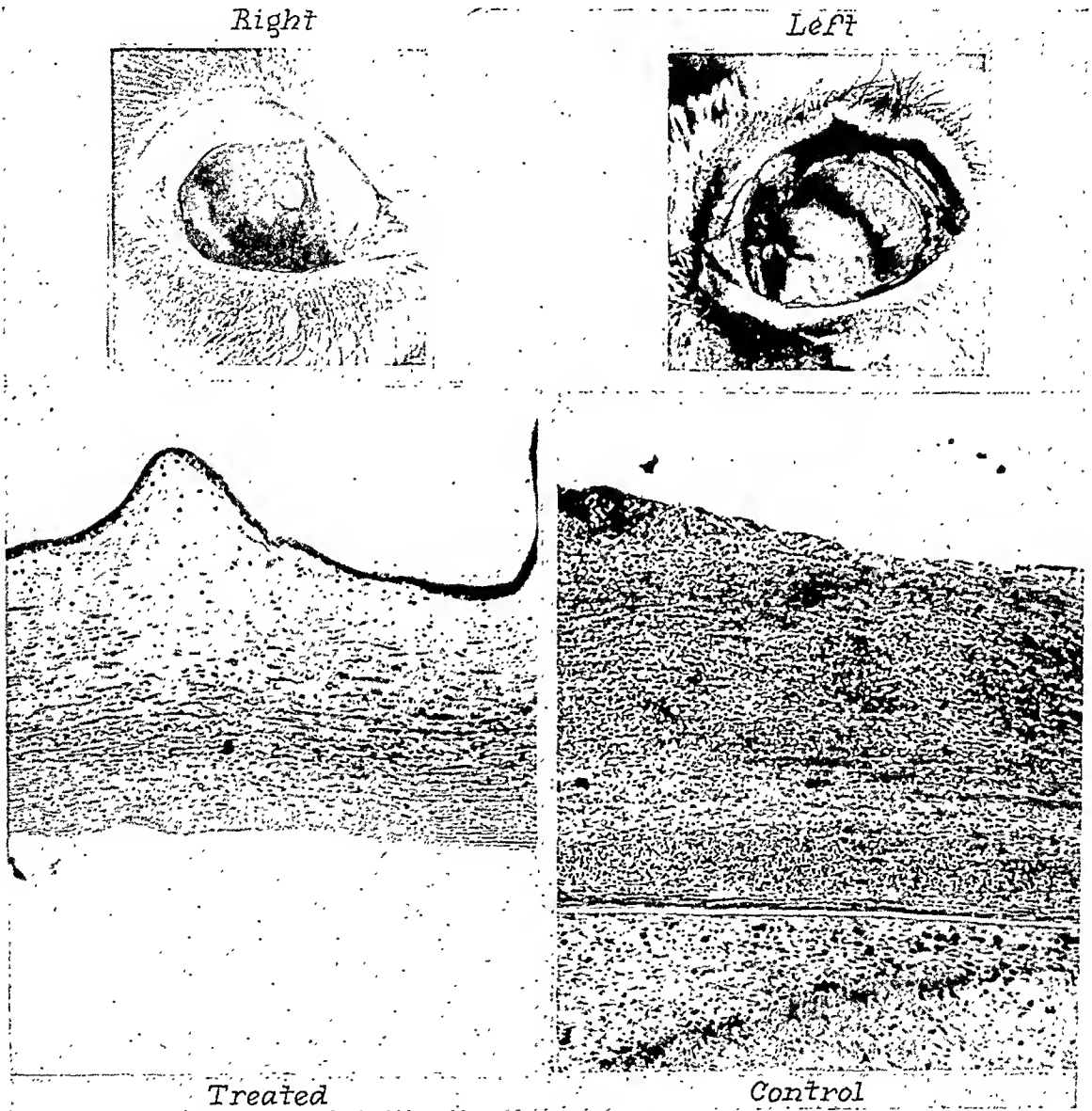


Fig. 2 (Leopold and LaMotte). The left cornea shows greater opacification, vascularization, cellular infiltration, and edema than the treated right cornea.

vulgaris and bacteria coli—continued to flourish in spite of therapy.

HISTOLOGIC RESULTS

The histologic course of a severe nitrogen-mustard burn has been adequately

less inflammatory cell infiltration of the corneal stroma than the untreated eyes. (2) Less corneal edema occurred in the treated eyes of the same four rabbits.

There was less inflammatory cell invasion of the anterior chamber in the

treated eyes of three rabbits, but this was not as striking as the reduction of corneal cellular infiltration.

corneal section showing the most histologic change. It is evident that in four rabbits the control cornea shows more

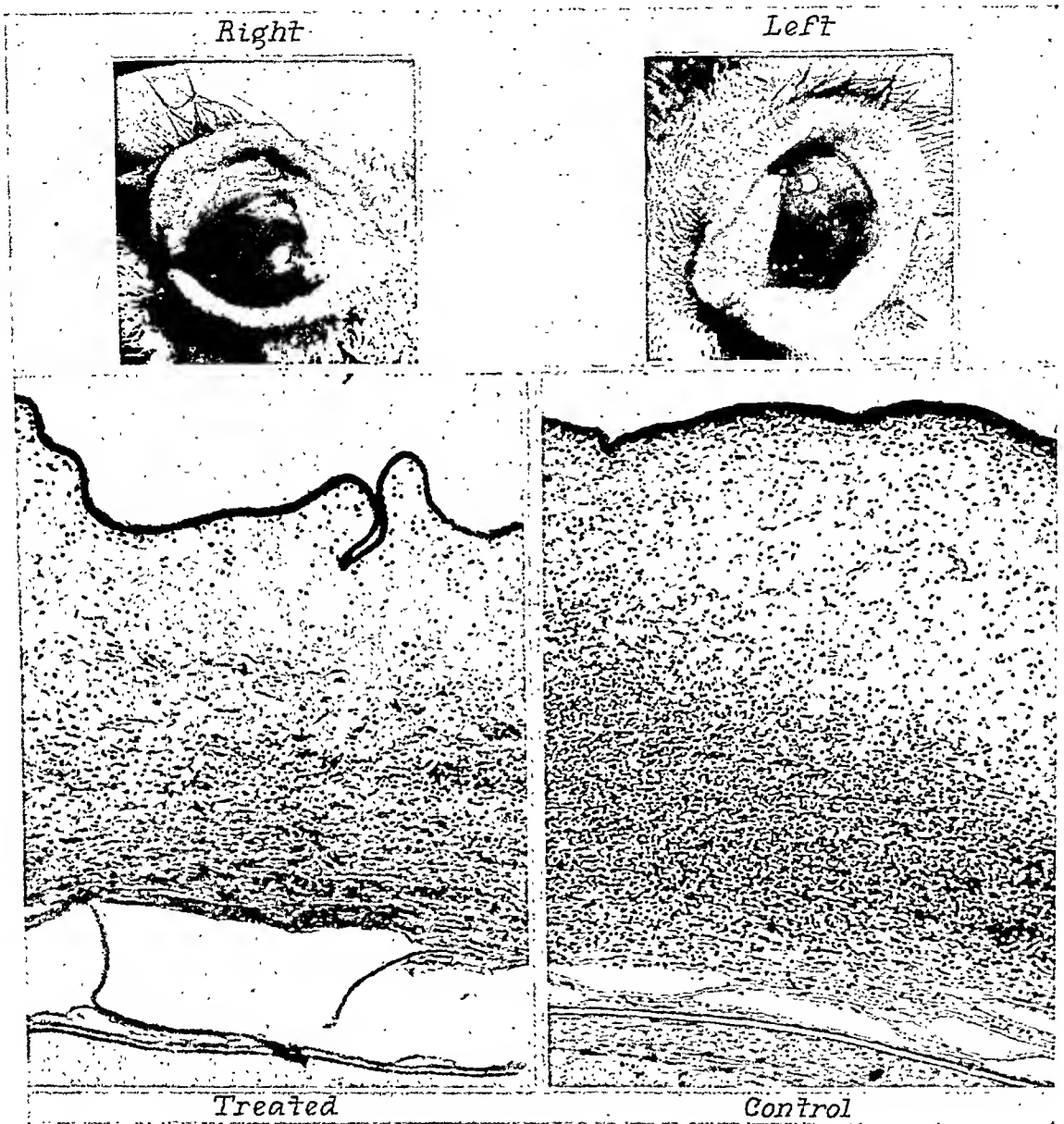


Fig. 3 (Leopold and LaMotte). The treated cornea shows decidedly less edema and cellular infiltration than the control but still shows considerable disturbance of the normal corneal structure.

The accompanying photographs show the treated and untreated eyes of all six rabbits after 21 days. The corneal microphotographs were taken at a magnification of $150\times$ through the portion of the

cellular infiltration and detritus than the treated cornea.

DISCUSSION

It is evident from these data that local penicillin therapy has a beneficial influ-

ence on the course of ocular burns due to liquid free-base nitrogen mustard. It is also fair to assume that, if all organisms had been sensitive to penicillin and, if animal resistance against infection did

in ocular burns due to mustard gas, and the influence of chemotherapeutic agents on the course of such lesions has been studied.^{10, 11} The data indicate that local sulfonamide therapy and local penicillin

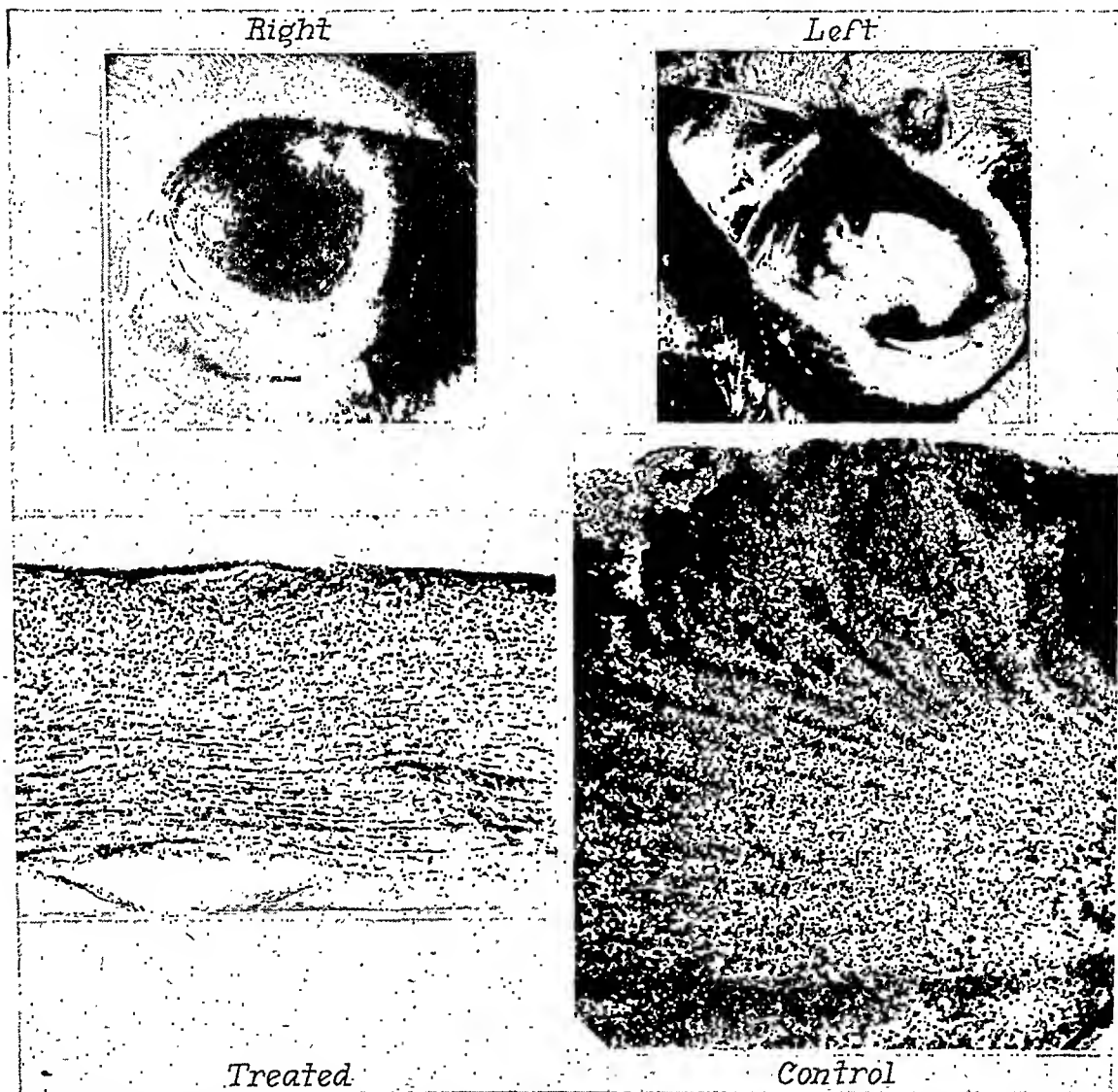


Fig. 4 (Leopold and LaMotte). The left cornea has almost perforated and the cellular infiltration is massive. The right eye shows decidedly less edema. Although the infiltration is less than in the control cornea, it is still marked.

not vary from animal to animal, the effect would have been even more striking. It is not necessary to point out that such treatment does not cure a severe splash-and-blink burn but simply decreases its intensity.

The significance of secondary infection

therapy, even more so, will reduce conjunctival discharge, bacterial flora, resulting lid deformities, delay the onset of corneal vascularization and, to a small degree, even reduce the amount of corneal edema. Histologic evidence of secondary infection has been demonstrated by

Hughes¹² to occur in lewisite-burned corneas and by Scholz¹³ to occur in nitrogen-mustard-burned corneas. Considerable

CONCLUSIONS

1. Local therapy with penicillin solution reduces the conjunctival discharge,

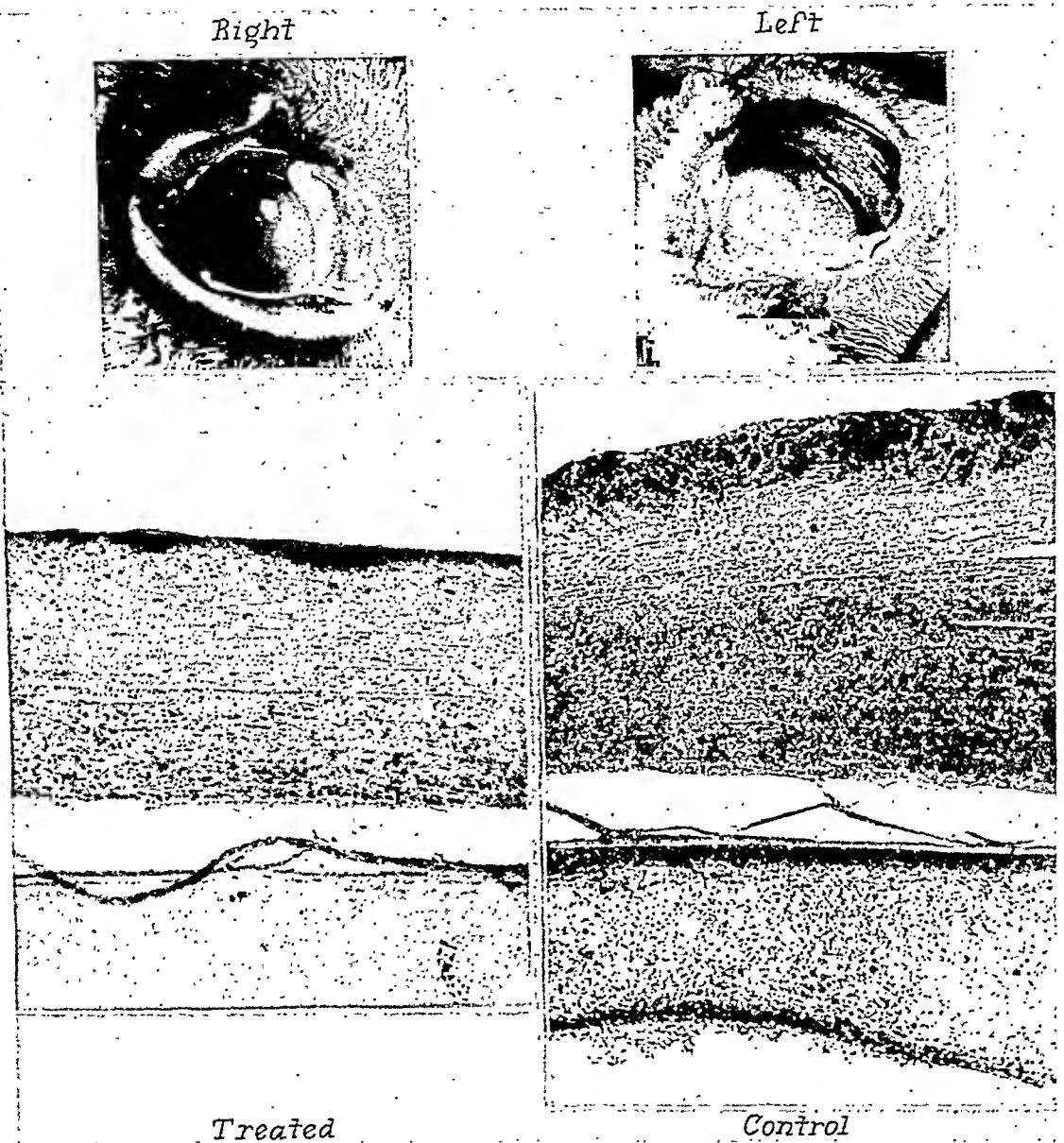


Fig. 5 (Leopold and LaMotte). The control cornea shows a severe corneal ulceration, cellular infiltration, cellular collection on posterior surface, and marked thickening. The treated cornea shows superficial infiltration.

evidence has thus accumulated that demonstrates the value of anti-infectious agents for the prevention of secondary infection in corneas previously damaged by a toxic chemical.

edema, and injection, delays the onset of corneal vascularization, and decreases slightly the amount of corneal edema of ocular lesions due to liquid free-base nitrogen mustard.

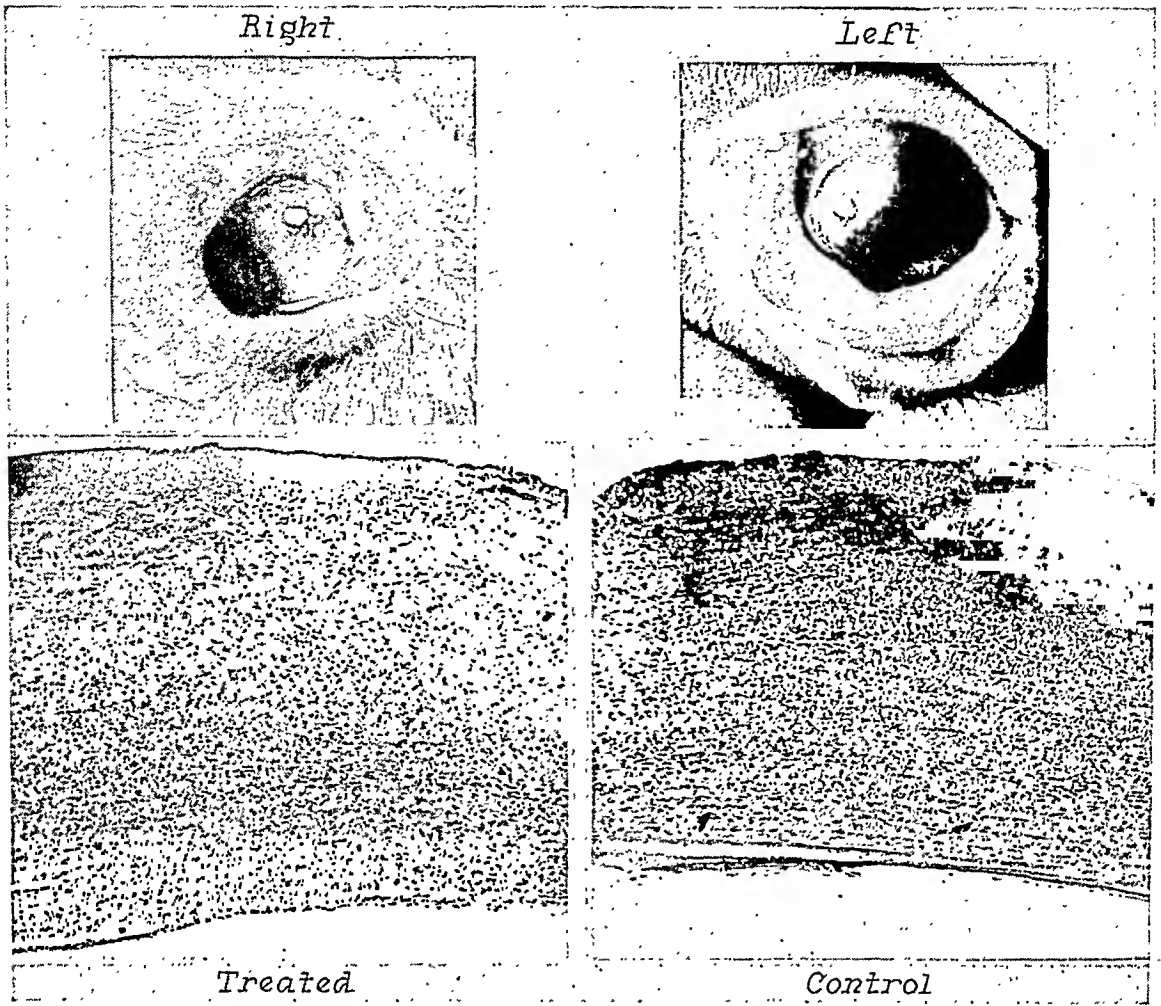


Fig. 6 (Leopold and LaMotte). Both corneas show opacification and edema to almost the same degree. The control eye shows slightly more cellular infiltration.

2. Local penicillin therapy decreases the bacterial flora in nitrogen-mustard ocular lesions.

3. The most marked histologic changes

altered by local penicillin therapy in nitrogen-mustard ocular lesions were the reduction in amount of corneal inflammatory cell infiltration and corneal edema.

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REGARDING GONIOPHOTOGRAPHY

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The technique proposed by Goldman for the study of the anterior-chamber angle has, doubtlessly, been simplified for daily application in the clinic.

This investigator has devised a contact lens provided with an inclined mirror that reflects the image of the angle of the anterior chamber for study with the slitlamp; by rotating the lens the angle can be studied in its entirety.

This procedure offers the advantage of permitting extensive studies, with the patient and the ophthalmologist comfortably seated as when making an examination with the slitlamp. In addition, it has the advantage of permitting the study of the angle with slits of variable widths; according to Busacca, when narrow beams of light are used, optical sections of the angle of the anterior chamber are observable, revealing its form with precision.

We have used Goldman's contact lens and Haag-Streit's slitlamp to obtain goniophotographs. For this purpose, as shown by figure 1, in place of one of the

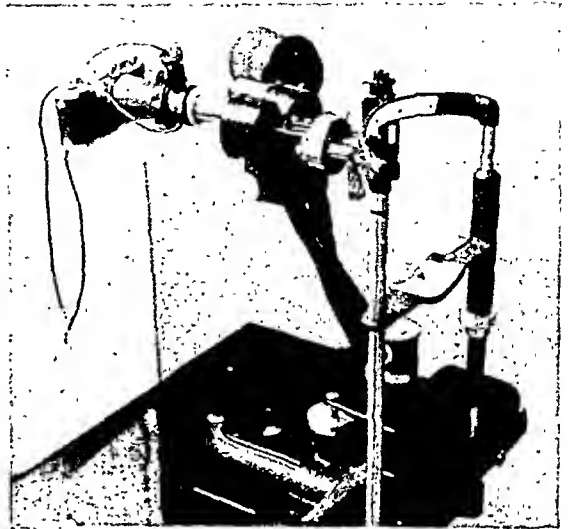


Fig. 1 (Barrios and Barriere). A Leica camera is inserted in place of one of the oculars of the corneal microscope.



Figs. 2, 3, and 4 (Barrios and Barriere). Different aspects obtained when wide or narrow slits are used.

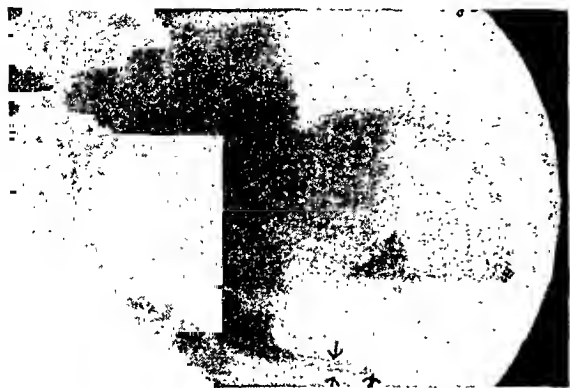


Fig. 5 (Barrios and Barrierre). An eye with a dilated pupil.

oculars of the corneal microscope, a Leica camera provided with Leica's microscopic device is inserted. This device has a lateral visor which permits the exact focusing of the part to be photographed.

The procedure is carried out as follows:

The usual steps for studying the angle are taken; then, the Leica, with the micro-Leica in place of one of the oculars, is adjusted. Upon looking through the lateral visor, it will be seen that it has a reticule, the lines of which are sharp and definite when focusing with the lens on this lateral visor.

The first step, therefore, is to focus exactly the lens of the lateral visor so that the lines are sharp and clear. Then, with the micrometer, the part that is to be photographed is focused. The Leica must be kept "open" and, through a double release, the following manipulations are obtained: (1) the closing of the lateral visor, and (2) the opening of the diaphragm which permits a variable opening according to the requirements of the case.

In our cases, with Plus-X films, we give 0.5- and 1-second exposures. Unfortunately, we have not been able to obtain color films for artificial light. We believe that with such films it would be possible to obtain far more exact photographs, since these would clearly show the different colors observed in the region.

The accompanying illustrations show the different aspects obtained when wide or narrow slits are used. In taking figure 2, the slit was entirely open. To interpret these photos, it is necessary to remember that an image is obtained in the mirror on the opposite side of the angle. In the case of figure 2, one sees the pupil and, underneath it, a horizontal line (B) corresponding to the limit of the mirror. The opposite angle of the anterior chamber is also reflected (A) which appears as an inclined plane, because that is the position occupied by the reflecting surface. Underneath is a series of lines of little importance because they are merely reflexes in the limit of the contact lens. In figure 3, the slit was narrower, and in figure 4, still narrower. It is possible to narrow it more, but the resulting photograph is not so clear.

As can be appreciated, the narrow slit permits following the faces of the angles and gives us a good impression of depth,



Fig. 6 (Barrios and Barrierre). Same eye as in figure 5 photographed with a narrow slit.



Figs. 7-10 (Barrios and Barriere). Fig. 7, Photograph with ample angle in which sense of depth is evident. Fig. 8, A case of traumatic iridodialysis. Fig. 9, An antiglaucomatous iridectomy. Fig. 10, This shows the gap opened by the cyclodialysis in a case of essential atrophy of the iris.

not obtainable with the wide slit. It permits, in addition, the comparison of the different angles and their classification according to width. Figure 5 shows an eye with dilated pupil. The folds of the roof of the iris can be clearly seen; these are formed by the dilatation. The arrow shows Schwalbe's line, and, exactly in the angle, a pigmentary nevus can be observed.

Figure 6 is of the same eye, but obtained with a narrow slit. The nevus and Schwalbe's line can be observed, as indicated by the arrows.

Figure 7 is a photograph with ample angle, and all the details are clearly defined; the sense of depth is evident.

Figure 8 corresponds to a case of trau-

matic iridodialysis. The pupil can be seen, and, at the right, the dialysis zone. In the inferior part is seen, reflected in the mirror, the superior part of the angle of the anterior chamber. The details of the iris can be clearly seen. With this procedure, excellent photographs of the iris can be obtained. Figure 9 corresponds to an antiglaucomatous iridectomy. Finally, figure 10 shows the gap opened by the cyclodialysis in a case of essential atrophy of the iris.

We believe that the perfection of this technique, and especially with the use of color films, will place this procedure among the most useful for goniophotography.

Sán José 885.

NOTES, CASES, INSTRUMENTS

RETINOBLASTOMA*

AN UNUSUAL CASE

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Boston, Massachusetts

It is hoped that by reporting the following case, a similar error in diagnosis and treatment may be avoided by others. This case also serves as a warning against the use of vitreous injections of penicillin in cases of obscure intraocular infections.

A review of the ophthalmic journals since 1925 failed to reveal a similar case. Other cases of mistaken diagnosis were reported, but none had a clinical picture as found in this patient.

The case history is presented in detail because: (1) the physical and laboratory findings, even in retrospection, easily lead to an incorrect diagnosis; and because (2) the patient was subjected to extensive surgical and X-ray procedures which were futile

CASE REPORT

P. W., a 3½-year-old boy, was first seen in the Eye Out-Patient Department of the Massachusetts Eye and Ear Infirmary on February 26, 1945, complaining of a red eye and questionable pain of five days' duration.

Three weeks before admission, according to the mother, the boy was hit in his right eye with a stick. His eye was not inflamed, nor did he complain of pain until five days before admission. At that time, his right eye became slightly inflamed, and he complained of a headache during the night. About this same time, the mother noted a "queer" appearance in the pupil of the right eye. The child's general health had been excellent with no recent illness.

* From the Massachusetts Eye and Ear Infirmary, Howe Laboratory of Ophthalmology.

Examination. The right eye was slightly injected. The cornea was clear with no evidence of recent nor old perforation. The anterior chamber was clear and of normal depth. The iris was normal, but the pupil was slightly dilated. The pupil did not react directly or consensually to light. Behind the lens there was a uniform, yellowish reflex that was structureless and appeared to be an exudate. The tactile tension was normal. Vision was nil. The left eye was entirely normal with a good red reflex.

Diagnosis. Metastatic endophthalmitis of the right eye was the diagnosis made.

On the same day, February 26th, the child was admitted to the Hospital for a complete medical work-up. The physical examination, X-ray pictures of the sinuses and chest, Hinton and tuberculin tests were all negative. On February 28th, the right eye was moderately injected, but otherwise was the same as on admission.

Because the "inflammatory" process appeared to be more active, the child was taken to the operating room on March 2d and, under ether anesthesia, a needle was inserted into the vitreous. Approximately 0.5 c.c. of creamy, yellow material was aspirated and 8,000 units of penicillin were injected into the vitreous. The aspirated material was sent to the laboratory for culture and identification.

On March 5th, the child was discharged with a diagnosis of vitreous abscess. The culture of the aspirated material revealed alpha hemolytic streptococcus, beta hemolytic streptococcus, and coagulase positive hemolytic staphylococcus. No focus for the intraocular infection had been found.

A week later, the child was seen in the Clinic, and the right eye was white and quiet. The fundus reflex was still yellow. No structure was visible to the vitreous

mass. On March 26th, the right eye was white and quiet, but the fundus reflex was now becoming gray. There was no visible structure to the material in the vitreous. On April 21, 1945, the right eye was slightly injected. The pupil was still dilated and did not react to light. The iris was now beginning to vascularize.

Four days after this, the child was brought to the clinic complaining of nausea and severe pain over the right side of his head. The eye was injected, and there were numerous new vessels on the iris, with early iris atrophy. The fundus reflex was gray, and there was no visible structure. The tactile tension was normal. The child was given aspirin and no local treatment.

On July 2d, the child returned to the clinic because the right eye had repeatedly "flared up." On this day, the eye was white, and the child did not complain of pain. The iris was atrophic and covered with new vessels. The pupil was moderately dilated and the fundus reflex was gray. There was no visible structure to the vitreous mass.

The child returned to the clinic on July 7th, because the right eye had become red and painful. He was admitted to the Hospital for enucleation of the right eye. On admission to the Hospital, the right eye was moderately injected. The cornea and aqueous were clear. The iris was atrophic and had numerous dilated vessels on the surface. The pupil was moderately dilated and did not react to light. The fundus reflex was gray-yellow, and no structure was visible. The tactile tension was normal. On the afternoon of admission, the right eye was enucleated. The child had an uneventful recovery, and was discharged on the fifth postoperative day.

On August 28th, the child returned to the Nose and Throat Clinic complaining of nasal discharge. X-ray studies of the sinuses revealed increased density in the

right maxillary sinus and the right ethmoid region. He was admitted to the Hospital, given intramuscular penicillin, had an uneventful recovery, and was discharged 14 days later. In the meantime, the right socket had healed completely.

The child returned to the Eye Clinic for a routine check-up the first day of October. The pathologic report on the right eye was returned with a microscopic diagnosis of retinoblastoma that had invaded the optic nerve to the cut end. When the eye was opened, the vitreous was filled with homogenous, gray-yellow, structureless debris; and the gross pathologic diagnosis was vitreous abscess. It was only after the routine microscopic examination that the diagnosis of retinoblastoma had been made.

X-ray films of the head, chest, and pelvis were all negative for metastases. Complete physical examination for evidence of metastasis was also negative. On the basis of these negative findings, the child was admitted to the Hospital for exenteration of the right orbit.

On October 2d, under ether anesthesia, an exenteration of the right orbit was performed. The lids and orbital contents were all removed by block dissection. The patient had an uneventful postoperative course, and was discharged on November 2d. Two days before discharge, the microscopic report on the optic nerve removed during the exenteration was returned. The optic nerve was found to contain tumor tissue up to the cut end at the optic foramen. This tumor tissue apparently had not invaded the surrounding tissue and appeared to be confined to the optic nerve only. X-ray films were again taken and were found to be negative for metastases. On November 5th, examination showed the socket to be granulating in very well.

Three days later, the child returned to the Nerve Out-Patient Clinic of the Mas-

sachusetts General Hospital, where a complete neurologic examination failed to reveal any evidence of metastatic lesions. The child was given an appointment for admission to the Massachusetts General Hospital for a right frontal craniotomy and removal of the right optic nerve up to the chiasm. He was admitted to the Massachusetts General Hospital on November 13th. Complete physical, neurologic, and X-ray examinations were negative for metastatic tumor. The next day, under intra-tracheal gas-oxygen-ether anesthesia, a right frontal exposure was made. The right frontal lobe was retracted and the right optic nerve was exposed. There was questionable enlargement of the right optic nerve. The right optic nerve was severed at the chiasm and removed in block dissection. No abnormal tissue was noted in the area.

On December 6th, the child was seen in the Nerve Out-Patient Department where all surgical wounds were found to be well healed. According to the patient's mother, the child had been vomiting after each meal for about three days. When the child was seen in the Eye Out-Patient Department on December 27th, the socket was well healed. There were three firm, painless lumps about the size of duck's eggs on the right forehead. The mother stated that these lumps first appeared three weeks earlier and had rapidly increased in size. The patient was still vomiting after meals and complained of pain over the right frontal area. He was admitted to the Massachusetts General Hospital for deep X-ray therapy. Physical examination on admission revealed multiple, painless nodules over the right forehead and vertex. X-ray films revealed destruction of the paper plate of the ethmoids on the right side, with loss of the entire lower and inner orbital rim. The destruction also involved the right frontal bone and sinus. Other X-ray films were negative for metastatic lesions.

Deep X-ray therapy was started the next day. During the following 17 days, he was given a total of 2,900 R. units through a single portal covering the right orbit and forehead; and 1,900 R. units were applied to the vertex lesion. The 2,900 R. units were given with the 1,200 K. V. X-ray machine in doses of 300 R. units per day; while the 1,900 R. units were given with the 200 K. V. X-ray machine, 300 R. units per day.

Despite the above heavy doses of X ray, the superficial lesions increased rapidly in size, and the orbital cavity became filled with new nodules. The child became progressively drowsy, lost weight, and vomited all feedings. He was discharged on January 15, 1946, because further therapy was deemed hopeless.

On February 26th, the child died at home. According to the mother, during the last two weeks of life the nodules became much larger, the child became more irritable and irrational, and he suffered severe pain. Unfortunately, no autopsy was performed to determine the extent of the metastases.

SUMMARY

In summarizing this case, the following features appear important:

1. The clinical picture of a homogeneous, yellow, avascular mass floating in the vitreous, typical of a vitreous abscess, proved to be necrotic tumor tissue.

2. The culture of the aspirated vitreous material revealed three pathogenic organisms which are difficult to explain on the basis of contamination. This culture, together with the clinical picture, resulted in the incorrect diagnosis of vitreous abscess.

3. The gross examination of the globe, following enucleation, failed to reveal the presence of the retinoblastoma. The correct diagnosis was made only after routine histologic examination.

4. The extensive surgical procedures of

exenteration and craniotomy failed to prevent a fatal outcome, although they seemed justified at the time as the only hope.

CONCLUSIONS

This case illustrates an error in diagnosis that resulted in death from retinoblastoma. With the widespread use of penicillin in ophthalmology, it serves as a warning against the use of vitreous injections of penicillin in suspected infections unless the diagnosis is certain.

This case also lends support to the belief that irritable or painful blind eyes should be enucleated and subjected to detailed histologic examination.

In cases of retinoblastoma with definite extension in the optic nerve and no evidence of metastasis, extensive surgical procedures must be carried out with a very guarded prognosis.

The failure of superficial metastatic nodules to respond to a large dose of deep X-ray therapy illustrates the relative resistance of some retinoblastomas to this type of treatment.

243 Charles Street (14).

ary 18, 1945, he came to Dr. Frey's Clinic with the complaint of a red, painful eye of two weeks' duration. There was no history of trauma.

Examination. The right eye was normal in all respects with normal vision with correction. The left eye had moderate

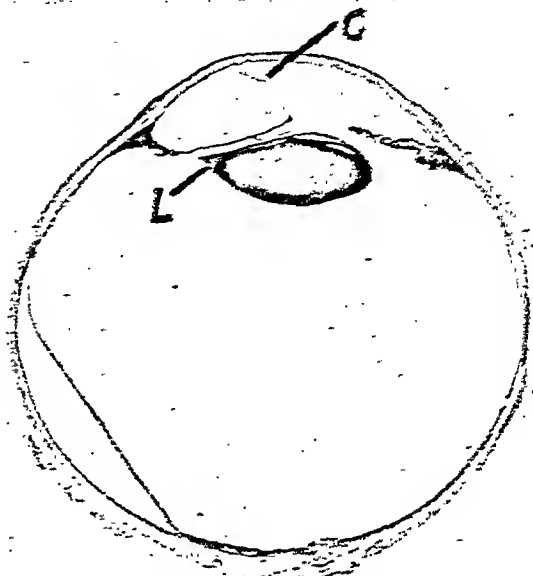


Fig. 1 (Laval). A large cyst (C) has replaced the iris and occupies part of the anterior chamber. It has compressed the lens (L) where it lies in contact with it.

SPONTANEOUS CYST OF THE IRIS*

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HISTORY

L. P., a man aged 57 years, had had the right kidney removed in May, 1930, for hypernephroma, confirmed on pathologic examination. There were no bone nor visceral metastases at that time. In January, 1944, a mass the size of a grapefruit was noticed in the right flank. It was very firm, hard, and attached to the crest of the ilium. The patient said it had grown slowly for the past four years. On Janu-

circumcorneal injection with an occasional cell in the aqueous. A large, pale brown, cystic mass filled the temporal half of the anterior chamber, pushing an ovaly distorted pupil nasally. It almost, but not quite, reached to the pupil. There were some blood vessels on the anterior wall of the cyst, and the whole mass transilluminated easily. The pupil could not be dilated so that the fundus and media were not examined. Vision of the left eye was finger counting at two feet and was not improved. Tension was: O.D., 20 mm. Hg (Schiotz); O.S., 25 mm. X-ray studies for metastases were negative. X-ray pictures of the orbit were also negative. The urine, blood count, and the Wassermann reaction were negative. One week after admission, the left

*From the Laboratory of the Manhattan Eye, Ear, and Throat Hospital.

eye was quiet and there was no injection of the globe; the aqueous was clear.

It was decided to enucleate the globe because of the history of hypernephroma of the kidney. Although the mass in the anterior chamber transilluminated, the possibility of a metastasis from the hypernephroma had to be considered.

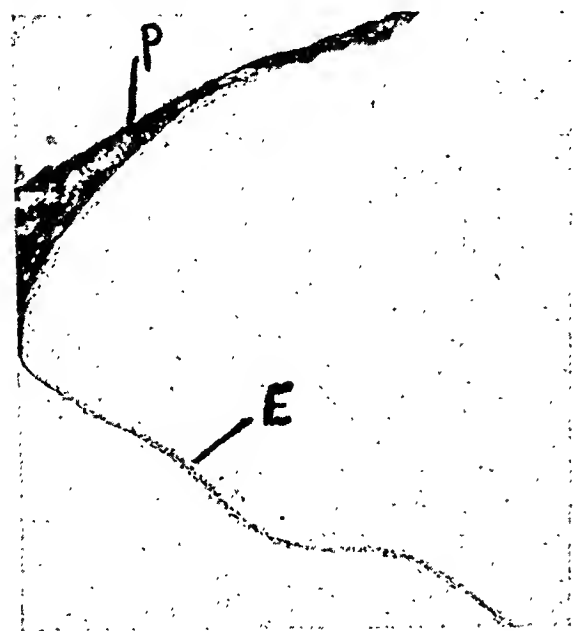


Fig. 2 (Laval). Some of the pigment epithelium (P) is still present and shows areas of cystic degeneration. The endothelial membrane (E) has several layers of cells.

The use of X-ray therapy was also considered, but the final decision was that enucleation was the best thing for the patient.

PATHOLOGIC FINDINGS

The globe was normal in appearance, size, and shape. On section no gross abnormalities were noted except for the cyst in the anterior chamber.

Microscopic studies showed no abnormalities except in the anterior segment. A large, empty cavity, lined by a thin layer of tissue, replaced part of the iris. The remaining iris was deeply pigmented in the region of the anterior border layer, and crypt formation was ab-

sent. There was an increase of chromatophores throughout the stroma, and the iris blood vessels were more numerous than usual. The filtration angle was normal in this region.

On the opposite side, where the iris was missing, the usual filtration angle was entirely absent, and the ciliary body itself had an obtuse angulation. The scleral spur was present and so were the pectinate ligament and Schlemm's canal, but the fibers of the ligament were closely packed and compressed and separated from the anterior chamber by a thin, but solid, membrane. Schlemm's canal was filled with blood cells (probably a post-enucleation result, since the anterior ciliary vessels here were also blood filled). The membrane which lined the filtration angle was continuous along the cornea in contact with, but separately defined from, Descemet's membrane. It was lined with its own endothelium, and the two endothelial surfaces lay back to back. The membrane continued along the anterior face of the ciliary body and then replaced the iris which should normally have been there. It was lined with a layer of pigmented iris epithelium (although somewhat atrophic in appearance) posteriorly. As it lay in contact with the lens, some of the pigment became attached to the anterior capsule and the pressure exerted on the lens caused an indentation in its contour. At this point, the lens cortex was compressed down to the nucleus. A few vacuoles had developed in this region. As the membrane left the posterior region of the iris, it lost its pigment layer and, as it curved forward in the anterior chamber, its anterior wall consisted of endothelial cells in several layers which became compressed into a single layer where they lay in contact with the posterior corneal surface. The cyst cavity was entirely empty having lost its fluid on sec-

tioning. There was no evidence of cupping of the optic nerve head.

COMMENT

Spontaneous cysts of the iris stroma usually occur in young people under 20 years of age, but one case was reported in a man of 58. They rarely give rise to any symptoms of irritation or to glaucoma. According to Duke-Elder, only 41 cases up to the present have been recorded and accepted as spontaneous cysts without any prior trauma. There is no consensus as to whether the cyst is mesodermal or ectodermal in origin, but the fluid is secreted by the epithelial cells which line the cyst cavity. The textbooks of Collins and Mayou, Fuchs, and Duke-Elder and the *Atlas of Histopathology of the Eye* by A. Fuchs, parts one and two, have no illustrations of a case similar to the one here presented.

136 East 64th Street (21).

A SIMPLE METHOD OF REMOVING EYELASHES BY ELECTROLYSIS*

JACK S. GUYTON, M.D.
Baltimore

The root of an eyelash may be destroyed by electrolysis without causing detectable scarring. A galvanic unit such as that devised by Walker may be used for this purpose. However, few ophthalmologists have access to such a unit, and all too many patients with wild lashes are treated by simply pulling the offending lashes every few weeks. Permanent removal of these lashes by electrolysis can be extremely simple, and every ophthal-

mologist could have available the following inexpensive equipment.

SIMPLIFIED EQUIPMENT

- 1 45-volt "B" battery
- 1 6-ft. strand of insulated copper wire
- 1 22,000-ohm resistance (price = 9 cents)
- 1 hemostat
- 1 very small straight needle with a sharp point
- 1 piece of gauze

TECHNIQUE

Novocaine is injected around the offending lash. The 22,000-ohm resistance is connected to the negative pole of the "B" battery and the wire is attached to this. The other end of the wire is attached to the handle of the hemostat, and the needle is grasped with the hemostat. The ophthalmologist holds the hemostat with a piece of gauze as insulation. The patient is asked to grasp the positive pole of the "B" battery firmly between thumb and forefinger, moistened with saline. The tiny needle is then inserted alongside the offending lash down to the lash root (about 3 mm.) and held there until bubbles of hydrogen come out freely and the lash itself floats out. This usually requires from 5 to 30 seconds.

The principle involved in destroying a lash root in this simple manner is to pass a galvanic current of from 0.2 to 2.0 Ma. through the patient's body. Since the needle (cathode) inserted into the lash root is very small, a sufficient concentration of hydroxyl ions is generated around the needle tip to destroy the hair follicle. The desired amount of current is obtained with a 45 volt "B" battery and a 22,000-ohm resistance in series. The electrical resistance encountered at the contact between fingers and positive terminal of the battery usually varies be-

*From the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital.

tween 10,000 and 100,000 ohms, and the resistance at the tip of the needle is negligible. There is no danger of obtaining too much current because this is limited to 2 Ma. by the resistance unit, even should there be almost no resistance elsewhere in the circuit. Too little current can be obtained if the positive terminal of the battery is not grasped firmly or if the fingers are not moist. The time necessary to accomplish destruction of the hair follicle varies inversely with the amount of current.

The simplified equipment listed above may be elaborated upon, if the ophthalmologist so desires, by: (1) wiring to the positive terminal of the battery a metal sheet which can be grasped by the patient's hand or strapped to his arm, (2) wiring the negative terminal directly to a needle which is insulated except for the tip, (3) insertion of an ammeter in the circuit. However, these elaborations are not at all necessary.

A MOTOR-DRIVEN OPHTHALMOTROPE

MERRILL J. REEH, COL. (MC), A.U.S.,
E. W. STIMMEL, AND F. V. HEAGAN
Randolph Field, Texas

In teaching large numbers of graduate physicians at the Army Air Forces School of Aviation Medicine, it has been found that the majority have little knowledge

concerning the normal and abnormal functions of the extraocular muscles. A small percentage possess knowledge of the function of individual muscles acting upon the globe while in the primary position, but have no understanding of movements in the secondary fields or of the conjugate function involved in the maintenance of binocular single vision. A logical understanding of heterophoria, heterotropia, and paralysis is impossible if the normal functions are vaguely or incorrectly understood.

In order to teach this branch of ophthalmology to a large group in an extremely limited period of time, a motor-driven ophthalmotrope has been constructed (figs. 1 and 2).

Each plastic globe,* 20 inches in diameter, is mounted on a movable table which is 30 by 40 inches in size. An anterior segment showing a cornea, anterior chamber, and iris has been attached to the globe proper. The inner surface of the globe has been painted white. The globe is attached to the stand by means of a ball-and-socket joint. Rotation is present about three axes; however rotation cannot be accomplished in the anterior-posterior axis with the present motor arrangement. Nevertheless, the student can

* The plastic globes were originally planned and developed by Dr. R. G. Scobee, St. Louis, Missouri, while on duty at the A.A.F. School of Aviation Medicine.

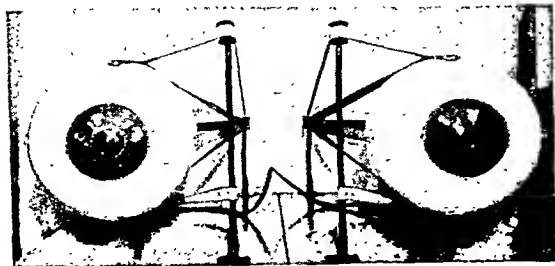


Fig. 1 (Reeh, Stimmel, and Heagan). Front view with eyes in the primary position.

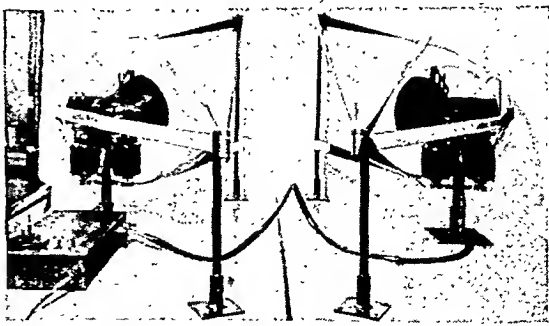


Fig. 2 (Reeh, Stimmel, and Heagan). Rear view with eyes in the primary position.

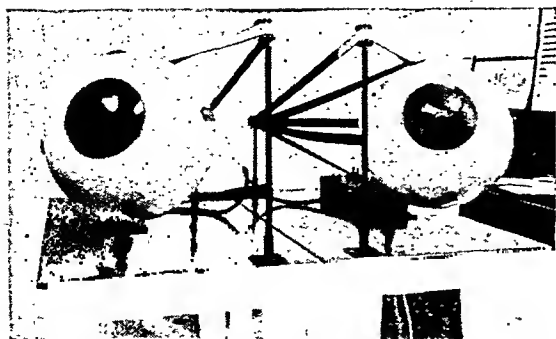


Fig. 3 (Reeh, Stimmel, and Heagan). Front view with eyes rotated right and upward.

readily understand such rotation while watching the various movements of the globe. Two one-seventy-fifth h.p. motors are attached to each globe. One motor abducts and adducts, and the other elevates and depresses the globe. When acting simultaneously, both motors move the globe into an oblique position; for example, right and upward (fig. 3). The globes have been mounted on separate, movable tables so that only one need be utilized if desired. The motors attached to both globes have been synchronized so that they move together at the same rate of speed; thus demonstrating conjugate (yoke) action of muscles. Automatic stop switches act in the same capacity as check ligaments. There is a separate switch for each globe in addition to the two master switches in the main control box. This permits the operator to stop one globe during binocular rotation; thus simulating the lag which is manifested by a paralyzed muscle. The muscles have been made of red-colored elastic straps bearing the appropriate name in black letters. The elasticity thus simulates the normal muscle tonus. The superior and inferior rectus muscles produce a 25-degree angle,

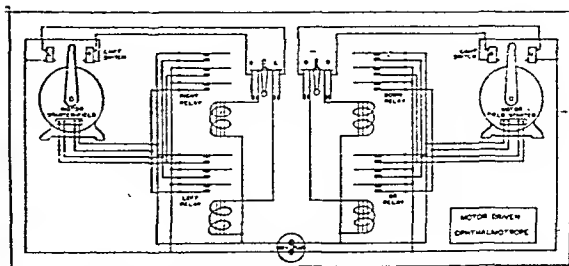


Fig. 4 (Reeh, Stimmel, and Heagan). Diagram of the wiring of one globe. Wiring of both globes is identical.

and the superior and inferior oblique muscles produce a 54-degree angle, with the optical axis when the globe is in the primary position. A metal pulley acts as a trochlea for the superior oblique muscle.

By means of this apparatus, one can demonstrate the functions of the extraocular muscles when the globe is in the primary and secondary positions. The conjugate (yoke) functions can also be demonstrated, as well as the primary and secondary deviations found in various paralyzes. By means of the individual control of the globes, lagging and overaction as seen in various paralyzes can be simulated. In addition, this model can be used in demonstrating convergence and divergence, heterophorias, heterotropias, and the use of prisms for the measurement of vergence power.

CONCLUSIONS

A motor-driven ophthalmotrope has been developed for the purpose of demonstrating to students the normal and abnormal functions of the extraocular muscles. Such a model will be of value in the teaching of postgraduate students, medical students, and orthopticians.

A.A.F. School of Aviation Medicine.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

November 20, 1945

DR. THEODORE L. TERRY, *presiding*

A NEW SYNTHETIC MYDRIATIC

PROF. IDA MANN of Oxford, England, wrote a paper on this subject which was read in her absence by the secretary of the Society, Dr. Merrill King. She described a new synthetic mydriatic, known experimentally by the code name, E-3, and commercially as Lachasine, which was a benzylic ester of hydroxy-ethyl-di-methyl-ethyl ammonium chloride. For experimental use, a 1-percent solution was used. When used in healthy eyes, it appeared that E-3 could be used for diagnostic and refractive purposes the same way as atropine. The reaction was more easily reversed by eserine than that of atropine. In old people, however, it is not as safe as homatropine. It appeared to lie between atropine and homatropine in its strength of action on normal eyes.

In a second group of six treatment cases, E-3 was used satisfactorily as a substitute for atropine. In a group of six patients who had had general toxic symptoms from atropine and hyoscine, it was used satisfactorily without any general symptoms and was satisfactory to the patient. In a fourth group of 42 cases, E-3 was used with striking results. All of the patients in this group had had local atropine irritation after atropine had been used for a varying length of time. Some of these patients were also sensitive to hyoscine and homatropine. All of these cases were switched to E-3; no signs of local irritation were produced; and the

previous signs of irritation from homatropine and similar drugs disappeared while E-3 was being used. With this series, it was also noted that E-3 had to be used more frequently when being substituted for atropine.

This drug can be obtained commercially from Messrs. Allen and Hanbury, Vere Street, London W, 1.

HYPERTENSIVE RETINITIS

DR. ARTHUR J. BEDELL of Albany, New York, read an interesting paper on the above subject illustrated by a large number of very fine Kodachrome slides. The instructive value of these slides came, not only from the photographs of the various changes that occur in hypertension, but also from the pictures which permitted one to observe the alterations which took place in the same patient over a long time, often years. He stressed the changes seen in the blood-vessel walls, especially the narrowing of the arteries, compression of the veins when crossed by the arteries, and atheromatous plaques in the vessel walls. He said that mere tortuosity of the blood vessels was not evidence of hypertension. He presented evidence proving that edema of the retina is present prior to the formation of the star in the macular region and that, previous to death, the star lines become broken and partially absorbed, a sign of great prognostic significance. He illustrated the various types of hemorrhages and exudates seen in patients with hypertension.

Dr. Bedell believed that many patients were symptomatically relieved by operation. The headache, especially occipital, was frequently cured, and the blood pressure often, but not always, reduced. He stated that hemorrhages and exudates

may disappear but stressed the fact that the retinal blood vessels rarely showed much improvement. The veins were more often decreased in caliber than the arteries. He had seen many patients in whom the retinal appearance was unchanged and the course of the hypertension uninfluenced.

Dr. Bedell felt that the term "transitory local constriction" of the arteries was to be preferred over "local spasm." He urged great care in describing the fundus changes to differentiate benign hypertensive retinopathy from the fulminating type.

Mahlon T. Easton,
Recorder.

NEW ENGLAND
OPHTHALMOLOGICAL
SOCIETY

December 18, 1945

DR. THEODORE L. TERRY, *presiding*

ACTION SPECTRUM OF ULTRAVIOLET KERATITIS

DR. DAVID G. COGAN said that the present study consisted of a quantitative determination of the ultraviolet bands capable of producing an abiotic reaction in the cornea and a comparison of the radiations which produce a keratitis with those which produce erythema. For the cornea, the action spectrum was found to have a sharp peak at 288 μ which is not materially different from the corrected peak for skin. Although there is no substantial difference in the absorption spectrum and action spectrum of skin, there is a difference in the absorption spectrum of the cornea and the action spectrum of keratitis. It was concluded that the absorption spectrum of the cornea is largely determined by the nucleoprotein (peak at 265 μ), while the action spectrum is deter-

mined by a photolabile substance with absorption shifted toward the longer wave lengths (peak at 288 μ). The action spectrum of keratitis is compatible with the assumptions that the photolabile substance is either one of the cytoplasmic proteins (albumen or globulin) or a specific portion (amino acids containing phenyl rings) of the nucleoprotein.

Since ultraviolet keratitis is a common occupational hazard (for example, among welders), the transmission characteristics of various types of common glass were measured for that portion of the spectrum which is responsible for keratitis. By comparison of these characteristics with the action spectrum for keratitis, it is possible to determine the amount of protection provided by any one glass.

This study was made with the help of V. Everett Kinsey, Ph.D.

RANDOM OBSERVATIONS ON OCULAR SURGERY

DR. CECIL S. O'BRIEN read an interesting paper on the above subject. Dr. O'Brien said that morphine may be given preoperatively unless there is a wide corneal section. There is danger, of course, from vomiting. For topical anesthesia, cocaine is used, with the exception that, in glaucoma where the pupil is not to be dilated, pontocaine is used. Cocaine is also injected subconjunctivally in a 1-percent solution. Retrobulbar injection of procaine is one of the most important developments in ocular anesthesia. Akinosis of the orbicularis can be obtained by the O'Brien technique of injecting the branch of the 7th nerve. Preoperatively 5 to 20 million units of typhoid vaccine are given for prophylaxis, one or two days before the operation. Penicillin ointment is used every two hours for two days before the operation. For cataract operation, the pupil is dilated with homat-

ropine and paradrine. Dr. O'Brien believes that the axis of the section may cause the resulting cylinder axis to be off. The easy method and the type that gives less astigmatism of section is to begin with a keratome and enlarge with the scissors. The basal iridectomy is preferred because there is less loss of vitreous. He prefers modified Stallard suture with two more sutures, one on either side of the center suture. Air is injected into the anterior chamber to prevent anterior synechia and incarceration of the iris. No ointment is used in the dressing because of the danger of its getting into the anterior chamber. If both cataract and indications for glaucoma surgery are present, Dr. O'Brien prefers a cataract extraction plus a Lagrange operation.

In cyclodialysis, he believes that almost half the circumference should be done, if possible. Dr. O'Brien also feels cyclodialysis is the best operation for glaucoma when tension is slightly increased, and there is a small visual field. In aphakic cases of glaucoma cyclodialysis is the operation of choice. Gonioscopy is of value in determining the area upon which to operate.

In surgery for convergent strabismus three important factors must be taken into consideration in order to obtain maximum results: (1) Proper correction for the refractive error must be worn for at least one year; (2) effect of occlusion on amblyopia; (3) effect of proper training.

In strabismus of more than 15 degrees, he prefers a two-stage operation. First, recession of the internal rectus, and then, three or more months later, resection and advancement of external rectus. The most frequent causes of failure in strabismus surgery are: (1) poor vision in one eye; (2) inferior oblique spasm; (3) abnormal correspondence; and (4) eccentric fixation.

Dr. O'Brien stated that an adequate approach to tumors of the orbit could be obtained by doing a wide canthotomy and enlargement of the wound into the fornix. He felt the cosmetic result was better after using this method than when some of the other approaches were used.

Dr. Mahlon T. Easton,
Recorder.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

January 8, 1946

DR. C. K. LEWIS, *presiding*

RETINOBLASTOMA

DR. E. C. ELLETT reported an unusual case of retinoblastoma. On April 13, 1944, Edward M., aged eight months, was seen. The right eye had been inflamed for two days. He had had similar mild attacks twice before. There was a history of bumping the head. The left eye was normal. The right lids were swollen and red. The conjunctiva was edematous; the cornea was normal; the aqueous, dark and cloudy; and the pupil only faintly seen. There was a tremulous look to the iris. Tension was +2. Faint reflex and faint light were present on transillumination. The condition appeared to be a contusion with hemorrhages in the eye or a metastatic ophthalmia. General examination, X-ray studies, and all laboratory tests were negative (Dr. Arthur Quin).

Sulfanilamide was ordered (2½ gr. four times a day). The eye cleared, tension seemed normal, and two small, white nodules appeared on the temporal half of the iris. The child did not seem sick and, on April 29th, the eye was white, tension normal, pupil wide, and reflex fair. The white dots on the iris remained the same.

On May 6th, the child was fretful as if in pain. The aqueous was lightly tinged with blood, and the pupil was only visible by transillumination. The eye cleared in a few days. Tension remained normal, but the aqueous was still reddish. On May 20th, the anterior chamber was full of blood, and a paracentesis was done, although the tension was normal. Much thin, bloody fluid escaped, and the eye collapsed but refilled by that afternoon.

The father, who was in service, was transferred to a post in Alabama, and the child was referred to Dr. C. A. Thigpen of Montgomery, who wrote on May 27th as follows: "Anterior chamber filled with blood, a diffuse haziness of the cornea, ciliary injection, unable to see the pupil with intense illumination, eyeball soft. The condition is certainly a very puzzling one, and I doubt very much if the fall had anything to do with it. It impressed me as being one of those rapid cases of acute uveitis, possibly, of tuberculous origin. The eye, in my opinion is doomed."

The child was seen by Dr. Anthony in August, who noted: "Right eye slightly congested. Tension, one minus. Cornea and ball look a little smaller than normal. Anterior chamber looks deep. Considerable amount of blood stain on posterior surface of cornea."

The next note was in a letter from Dr. Thigpen, September 18, 1945: "The outlook for the future of the eye was hopeless and so I advised the parents. The left eye was apparently normal so far as anyone could tell in so small a child."

"I neither saw nor heard of the case again until the early part of April this year when the parents returned saying that the child was losing the vision in the left eye. Examination disclosed a dilated pupil through which one could easily see a projecting floccular, white mass covering the entire temporal side of the retina

and extending below and across to the nasal side. This could be well seen without the ophthalmoscope. The mass was tremulous and the slitlamp showed no blood vessels. The eye was turned upward, and only a small area of the retina was sensitive and had any vision which was peripheral. There was no evidence of any inflammatory process. The tension was not above normal limits. The result of my examination convinced me that total blindness was inevitable.

"My verdict was so shocking and distressing to the parents that they hurried off to the Mayo Clinic and remained there several weeks, during which time penicillin and other remedies were used to no avail. Then, suddenly, the right eye became inflamed, followed by intense orbital cellulitis with marked exophthalmos, and removal of the eye was advised. This they decided not to do, but returned to Montgomery. I fully agreed that nothing short of enucleation could be considered. This was done today. I discovered that there had been a profuse retrobulbar hemorrhage which explained the exophthalmos. Thinking that you might be interested in the outcome of the case, I am sending you, under separate cover, the eyeball. There were so many adhesions that it was impossible to do a very clean enucleation."

The eye was sent to the Army Medical Museum, and they reported the preliminary examination on October 9th: "Reveals a retinoblastoma which has extended through the sclera, forming a small orbital tumor mass adjacent to the optic nerve."

In December, 1945, the left eye was enucleated. The child died, January 7, 1946.

OSSIFICATION OF THE CHOROID

DR. E. C. ELLETT reported the case of Mrs. P., who was seen in 1941 with a

history of the loss of the right eye at childbirth, 28 years before. She was said to have had a hemorrhage in or behind the eye. The eye was shrunken and divergent. The pupil was adherent to a cataractous lens. Tension was 18 mm. Hg (Schiøtz). She complained of pain around the eye and was advised to have it removed. The pain has continued in the eye and head without any change in the eye, but recently the eye seems tender and the possibility of ossification of the choroid suggested itself. X-ray pictures were taken by Dr. Anthony who will report on them.

GLAUCOMA SIGNS AND SYMPTOMS

DR. E. C. ELLETT reported a series of cases presenting the signs and symptoms of glaucoma without a rise of intraocular pressure.

Case 1. P. R., aged 60 years, was seen in 1943 with failing vision and a diagnosis of glaucoma two months before. Vision in each eye was 6/6 with glasses. He was a diabetic and on a diet. The discs were definitely white and cupped. Tension in both eyes was 18 mm. Hg (Schiøtz). He had had different opinions as to the advisability of operation. Fields were shown. Blood pressure was 175/125. Iridencleisis was performed in the left eye in May, 1943, and five days later in the right eye. In November, 1945, vision was still 6/6 in each eye. Tension was 15 and 23 mm. The discs were the same, and fields as shown.

Case 2. C. D., a man aged 68 years, had had blurred vision in the right eye for a year. Vision in this eye was 6/18 with glasses; in the left eye, 6/6 with glasses. The right eye showed a few lens and vitreous opacities. The optic nerve was white and slightly cupped. There was no overhang. Vessels were pushed nasally. In the left eye, the media were clear. The optic nerve was of a better color and less

cupped. Pupils were 4 and 3 mm. and feebly active. Fields were as shown. Tension was 20 mm. in both eyes. This patient was put on a 1-percent solution of pilocarpine. He was seen by Dr. Arnold Knapp who wrote that he did not think the trouble was glaucoma but was of vascular origin: "that type of optic atrophy with a shallow excavation which is probably due to interference in the nutrition of the optic nerve." He found the tension to be normal. In November, 1945, vision was: 6/15 and 6/6. Tension was: O.U., 30 mm. Fields were as shown.

Case 3. Mrs. C., aged 52 years, was seen October, 1945, with failing vision for a year. Vision in the right eye was poorer than in the left. The disc of the right eye seemed to be partially cupped. The left nerve was normal. Tension in both eyes was 23 mm. In December, the findings were the same. She had been told she had glaucoma and was using pilocarpine. The only field defect was a central blur in the right eye. Vision was: O.U., 6/7.5, with glasses.

Case 4. Mrs. T., aged 78 years, was seen October, 1945. She had been told she had cataracts. Vision was 6/7.5 and 6/15, with glasses. Tension was: O.U., 26 mm. Pupils were 5 and 5½ mm. and feebly active. Incipient cataracts were present. The optic nerves, clearly seen, were pale and slightly cupped. Fields were as shown. She was given pilocarpine drops. A month later the condition was unchanged.

This condition of signs and symptoms of glaucoma without a rise of ocular tension has been long recognized and frequently discussed. Fuchs thought that a weak lamina could yield while the nerve fibers were intact, and might yield before a normal intraocular pressure. Schnabel thought that the primary process was a neuritic atrophy forming small spaces which coalesce. The connective tissue pro-

liferates, contracts, and pulls the lamina back. Duke-Elder describes hypertension as "that pressure which the tissues of that particular eye are unable to withstand without damage to structure or function." Mauthner and Magitot think the condition represents a true glaucoma. Redslob reported a case with tension of 15 to 20 mm. not raised by provocative measures nor affected by a bilateral cervical sympathectomy.

Arnold Knapp, in 1932, made a most significant and valuable observation in attributing the trouble to radiographically demonstrable calcareous degeneration in certain arteries at the floor of the cranial cavity.

PERSISTENT EDEMA FOLLOWING NOVOCAINE INJECTION

DR. J. WESLEY MCKINNEY reported the cases of Mrs. L. R. and Dr. C. G. T. On December 11, 1945, a small chalazion of the right lower lid of Mrs. L. R. was curetted after novocaine infiltration. On the following day, December 12, a chalazion of the right upper lid of Dr. C. G. T. was curetted after novocaine infiltration. In both of these patients, there resulted a marked edema of both the upper and lower lids without induration or tenderness. There was no infection about the wounds which healed uneventfully. The edema, however, was of such degree as to be incapacitating for both and persisted for approximately four weeks in the former, and three weeks in the latter. The technique of injection and preparation of the novocaine from the ampules was, as far as we could determine, no different from that usually employed. From the box of novocaine ampules, three injections without unusual reaction had preceded these two. The remaining ampules were sent to the Winthrop Company for analysis. No impurity was found in the ampules examined.

BASAL-CELL CARCINOMA OF ORBIT

DR. J. WESLEY MCKINNEY reported the case of Mrs. J. T. P., aged 68 years, who gave the history of a sore at the inner corner of the right eye for nine years. This sore had gradually spread in spite of three series of five X-ray treatments. For the past three months there had been much pain, and there was an annoying diplopia.

Examination. Vision was: O.D., 6/12; O.S., 6/6. The left eye was normal. Between the right eyeball and medial wall of the orbit, there was a deeply excavated ulcer with granulating sides; the globe was fixed by the mass of infiltrating tissue. The eye was internally normal. General physical examination was negative.

On February 29, 1944, the right eye was enucleated, and the large electrocautery was applied widely to the orbital tissues. The cautery was held against the bone, nasally, to insure that any cancer cells that might have invaded the bone would be killed. Pathologic report was basal-cell carcinoma. The immediate post-operative course was uneventful. Over a period of several months, the orbital tissues granulated and became clean. Sequestra of bone have been removed from time to time. There are now several openings into the ethmoid and maxillary sinuses. No evidence of recurrence has been noted in the nearly two years since operation.

LYMPHOSARCOMA OF THE ORBIT

DR. J. WESLEY MCKINNEY reported the case of G. H. R., a man aged 59 years, who was first seen August 13, 1943. The history was that there had been swelling about the left eye for about three months. Three weeks before, the swelling had become rapidly more marked. Vision was much impaired. There was a feeling of fullness but no pain. He complained of general weakness.

Examination. Vision was: O.D., 6/6;

and O.S., 6/18. The right eye was normal except for a slight puffiness of the lids and a small subconjunctival hemorrhage, temporally. All around the left eyeball and displacing it inward was a firm mass which caused protrusion of the lids. A globular mass was seen pushing out the upper fornix temporally. The globe was fixed by the mass. The pupil was active, and the eye was internally normal.

A biopsy was taken from the subconjunctival mass, and the laboratory reported a highly malignant tumor of probable connective-tissue origin resembling melanoma without pigment and probably not radiosensitive. He was sent to an internist who reported no evidence of tumor elsewhere.

On August 20th, an exenteration of the orbit was performed, including the lids and periorbita. The entire mass was sent to the Army Medical Museum. The report sent back was: lymphosarcoma, mixed reticulum-cell type. On September 3rd, a small mass appeared in the right upper lid which disappeared promptly under X-ray therapy. On September 14th, many subcutaneous nodules appeared over the entire body. Three weeks later the patient died.

PANOPHTHALMITIS FOLLOWING IRIDENCELEISIS

DR. PHILIP MERIWETHER LEWIS reported the case of G. P., a white man aged 73 years, upon whom he had done a bilateral iridencleisis in 1937 for chronic simple glaucoma. For over eight years, the intraocular pressure remained normal and useful vision was maintained. About December 15, 1945, the left eye became quite red and sore. The pain became worse every day and, when seen on December 22, 1945, a purulent panophthalmitis was present. There was a spot of complete necrosis through the conjunctiva at the site of the scleral opening. Evisceration

was performed immediately. A purulent infection involved every structure of the eye except the lens. Penicillin ointment was put in the scleral cavity, and 20,000 units of penicillin were given intramuscularly every three hours for 10 doses. Recovery was uneventful.

This was the only panophthalmitis following iridencleisis seen in about 12 years' experience with that operation for glaucoma. It had occurred in two cases following trephines.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

December 20, 1945

DR. WARREN S. REESE, *chairman*

AMBLYOPIA DUE TO DIETARY DEFICIENCY

COMDR. A. D. BEAM (MC) U.S.N.R. (by invitation) reported on eight cases.

Early in the spring of 1944, the United States Naval Hospital in Philadelphia was designated by the Surgeon General as the national center for the rehabilitation of blinded personnel of the Navy and Marine Corps. Only those men whose vision was 20/200, or less, in the better eye, with correction, were admitted to this special service. At the time of the report, there had been 165 admissions. Of these patients, 101 had suffered loss of vision as a result of traumatic injury; 29, as a result of methyl-alcohol poisoning; and 27, following various ocular diseases. The remaining eight patients became blinded during their period of imprisonment under the Japanese. It is this prisoner-of-war group of patients with whom we are concerned in this report.

All eight of these men, with normal vision on enlistment, were captured at the fall of Corregidor. Five of them were marines and three were sailors. Only one

of them had sustained physical injury during the encounter prior to capture, and that injury was confined to the lower extremities. All of them were between 20 to 32 years of age. For a period of five months before capitulation, their living conditions had been far from satisfactory, and their diet had been rationed and steadily reduced. Following capture, all eight of these men survived the death march from Bilibid to Cabanatuan where six of them were imprisoned until the date of liberation on February 4, 1945. The remaining two had been taken to Japan after they had begun to have visual deficiency.

During their period of imprisonment, all of them were forced to engage in strenuous physical labor and suffered the physical hardships of a discipline now so well-known to all of us. Weight loss of these eight men varied between 40 to 70 lbs. Diet during the entire period of incarceration was far below that specified by international law. The average daily intake was 200 to 300 gm. of polished rice (about 7 tbs.), and a thin soup, made from sweet-potato vine, was given about three times a week. This constitutes a diet of approximately 1,000 calories per day. Occasionally the intake was greater or less, but this represents the usual food intake. All of these patients showed evidence of severe beriberi, and seven of them had pellagra of varying degrees of intensity.

Visual loss appeared in all of them without other specific prodromes and proceeded to the maximum deficiency in one to four weeks. Blindness in all of these prisoners developed between 4½ to 8 months after capture. Once the loss of sight was established, it remained static, even after they were freed and given various forms of therapy. Loss of vision was painless in each instance and, other than the signs of dietary insufficiency,

there were no common factors that would suggest a toxic, infectious, or traumatic etiology.

Seven of the patients also developed bilateral-nerve deafness; the loss of hearing varied from 11 to 36 decibels. Deafness was a feature concomitant with visual loss and was first noted at the time of blindness or soon thereafter. All of these eight men had some evidence of peripheral neuritis, as did nearly all of the other prisoners. None of these men had symptoms of night blindness but, on the contrary, found that their vision was better during twilight or early evening. Hypoproteinemia and occasional bouts of diarrhea were common to all of the prisoners, including those under discussion. All of these patients stated that there were many other prisoners who developed blindness in a similar manner, but who failed to survive the period of confinement for one reason or another.

These eight men with severely impaired vision present histories and physical findings which indicate that their visual loss probably resulted from dietary deficiency. However, the possible effect of some chemical intoxication cannot be completely disregarded, even though there does not seem to be any common factor. The effect of a prolonged deficiency diet upon the visual sense of man during a period of strenuous and enforced labor has never been determined. Therefore, the etiology may have been influenced by three groups of factors: (1) deficiencies in such required elements as vitamins, minerals, and proteins; (2) intoxications of a chemical and bacterial nature; and, (3) the effect of strenuous physical activity with inadequate caloric intake. We feel that we are unable to state just what influence each of these would have had upon the development of blindness under the circumstances just related but, from the endless array of published data, it

would appear that avitaminosis would be the principal factor to consider. However, in discussing vitamin deficiencies, I do not intend to exclude the possible effects of other contributing factors or to indicate any assessment of their influence.

Only the vitamins usually thought to be concerned with the physiology of the eye will be considered, excluding vitamin D.

Vitamin A. The minimum daily requirements for vitamin A is considered to be about 5,000 international units. The source of vitamin A in the diets of these men was limited to that contained in the thin soup made from vegetable leaves and water. None of these men suffered night blindness and only two showed evidence of corneal disease upon admission to our hospital. One patient had developed a perforating corneal ulcer in his right eye, although there were no opacities nor history of inflammation of the left eye. On examination, the lower two-thirds of the cornea of the right eye was opaque and vascularized, and there was an anterior synechia. The left eye did show proliferation of the limbic vessels. One other patient had suffered "sore eyes" three months after capture. An American doctor told him that he had corneal ulcers, which became symptomless with no change in diet and the treatment limited to instillation of yellow oxide of mercury, once daily. When this man was first examined here, there were seven or eight superficial opacities of each cornea associated with well-marked proliferations of the limbic vessels. The corneal opacities were not dense, and there was very little loss of corneal substance. These two cases may represent keratomalacia and xerosis of the cornea respectively, although neither of them showed evidence of conjunctival xerosis nor had they suffered hemeralopia.

Vitamin B₁. Vitamin B₁, or thiamin, has been proved necessary in maintaining normal neurologic function. Inadequate ingestion, absorption, or utilization of this heat labile portion of the vitamin-B complex causes the disease known as beriberi. The Committee on Nutrition of the National Research Council recommends between 1.5 and 2 mgs. daily for a well-balanced diet.

The rice which these men ate was chiefly polished. The polishing process, like the milling of flour, removes valuable constituents, notably the vitamins, protein, and mineral elements. The discovery that a diet which consists solely of polished rice will produce beriberi gave an early incentive to the study of vitamins. Polished rice is practically devoid of all vitamins, but beriberi is due specifically to the lack of vitamin B₁.

Each man in this group suffered symptoms of severe beriberi including peripheral neuritis, edema of the extremities, weakness, anorexia, and diarrhea. Palpitation and shortness of breath were noticed by three of them. Massive doses of vitamin B₁, given upon liberation in 1945, relieved all of these symptoms, but the amblyopia which had occurred during the attack of beriberi was not improved. One patient received large doses of vitamin-B complex, seven months after his vision failed, when the Japanese picked a group of 100 prisoners, all suffering from beriberi, to half of whom they gave vitamin therapy in addition to the usual diet; the other half of the group was kept on the unfortified rice and soup diet. This man improved during this study as far as his neuritis, edema, and weakness were concerned; however, there was no change in his vision during, or following, the six weeks of the experiment.

On admission to our service, the vision of these eight men ranged from 1/200 to 10/200 in the better eye. Each had bi-

lateral, absolute, central scotoma which extended 5 to 12 degrees from the fixation point; two also had bilateral, concentric contraction of the peripheral fields. The pupils were semidilated and reacted sluggishly to light. Fundusoscopic examination was essentially normal, except that each man showed evidence of bilateral optic atrophy varying from well-marked temporal pallor to advanced optic atrophy. The atrophy was of the primary, or descending, type. Treatment consisting of high vitamin diet supported by large doses of thiamin has failed to cause any visual improvement in these cases. There has been considerable evidence in the literature to support the theory that lack of thiamin in the diet may cause retrobulbar neuritis and optic atrophy, if the condition remains untreated. The dietary deficiency in chronic alcoholism is a classic example.

Vitamin B₂. Pellagra is a disease of nutrition caused by deficiency of vitamin B₂, or nicotinic acid. Although other factors of the B complex may contribute to this disease, their significance is uncertain. Typical cases of pellagra are characterized by three groups of symptoms: (1) a typical form of dermatitis; (2) digestive disorders with or without diarrhea; and (3) psychoses of the confusional type. Typical signs of this disease occurred in seven of the eight cases presented. The other patient apparently had no evidence of pellagra even to the extent of glossitis, which is often one of the first signs of nicotinic-acid deficiency. Although peripheral neuritis and optic atrophy have been attributed to this disease (P. B. Wilkinson), it is probable that concomitant vitamin-B₁ deficiency is the true etiologic factor. Optic atrophy and peripheral neuritis occurring in the one patient who suffered no signs or symptoms of pellagra tends to support this belief. These men suffered no ocular

change which we feel can be directly attributable to nicotinic-acid deficiency. Their pellagra healed soon after liberation, when they received large doses of vitamin-B complex.

Riboflavin. In 1940 Sydenstricker described the ocular effects of a riboflavin deficiency which included the symptoms of photophobia, sensations of roughness or burning of the eyelids, and visual fatigue. The commonest sign was circumcorneal injection, often with invasion of the cornea by capillaries from the limbic plexus. Superficial corneal nebulas were also noted. These signs and symptoms responded favorably to riboflavin therapy. Four men in this group had a history of "sore eyes" and photophobia during their period of incarceration. Three of the four exhibited definite limbic proliferation, and one showed superficial corneal opacities upon examination here. The remaining men showed no evidence of limbic proliferation. Local areas of proliferation, usually traceable to some antecedent corneal inflammation, were not considered. Symptoms of photophobia and burning were relieved soon after liberation, when adequate vitamin therapy was instigated; however, no change in the vessel proliferation was noticed during the past 8 to 10 weeks. Riboflavin (5 mg.) has been administered daily since they arrived here.

Vitamin C. The eye manifestations of vitamin-C deficiency are probably limited to ocular hemorrhage in patients with scurvy. However, there is some evidence that cataract formation may be influenced by lack of this vitamin in the diet. Three of these cases were told that they had scurvy at one time or another while prisoners on Luzon. Their description of the skin lesions is not typical, although their gums were swollen and bled easily. They gave no history of subcutaneous hemorrhage nor bleeding other than from the

gums and nose. Examination here revealed no ocular pathology attributable to vitamin-C deficiency.

Comment. In this group of eight men who became amblyopic on an inadequate diet during imprisonment, the outstanding ocular pathologic change common to all eight of them was the optic atrophy with central scotoma in each eye. Dietary deficiency, notably vitamin-B₁ deficiency, appears to have been the etiologic factor. Signs and symptoms of severe beriberi were present in each case; thus establishing proof of thiamin deficiency. An analysis of the diet, the bulk of which was polished rice, reveals little or no source of this vitamin. Rice, containing 79.4-percent carbohydrates, 7.6-percent proteins, and 0.3-percent fat, gave these men a high carbohydrate diet. It has been well established that thiamin requirements increase with the carbohydrate intake and with physical exertion. Ten hours of hard labor per day, associated with a high carbohydrate diet increased the vitamin-B₁ requirements. The need for thiamin was great, and the source was negligible. There is lack of evidence to support the influence of other avitaminosis on the amblyopia which these patients suffer.

Again, no attempt has been made to evaluate the significance of other possible contributing factors—dietary deficiency, intoxication, or circumstances of existence such as these men endured. Only under highly controlled circumstances could such a study be of definite value. Certainly these variable factors cannot be assessed in retrospect.

Discussion. Dr. Walter I. Lillie said that Dr. Beam, in presenting this series of cases and in describing typical, chronic retrobulbar neuritis with resulting simple optic atrophy due to vitamin-B deficiency, in sailors and marines who were prisoners of the Japanese, had definitely shown that they were actually due to the deficiency of vitamin B₁. Similar cases in the

Army personnel had been seen by him at Valley Forge Military Hospital; so one could conclude that all branches of the service, under similar conditions, were similarly affected. One of the sailors noticed that, on the polished-rice diet, his vision diminished; but, when he was fed the unpolished rice, his vision would improve. He always made an effort to obtain as much unpolished rice as possible. Dr. Lillie warned that in treating debilitated conditions due to dietary insufficiency, one must be careful in using glucose intravenously. If it is not fortified with vitamin B, it will utilize the remaining vitamin B in the body tissues and produce an added deleterious effect.

Dr. Lillie complimented Dr. Beam on the excellency of his presentation.

A METHOD OF CLOSING THE CATARACT INCISION

DR. P. H. DECKER (by invitation) described a method of closing the cataract incision by sliding a large conjunctival flap from above down over a corneal scleral suture. He said that this conjunctival flap will temporarily bury the corneal-scleral suture and the entire line of limbus incision. About the fourth or fifth day, the conjunctival sutures spontaneously cut out, allowing the conjunctival flap to retract; thus automatically exposing the corneal-scleral suture which is removed about the 10th day.

The principles behind this procedure are: (1) the corneal-scleral suture gives adequate strength to the incision closure preventing vitreous loss; (2) the conjunctival flap gives an adequate sealing effect to the incision closure, allowing rapid and early reformation of the anterior chamber. Combining these two principles—the corneal-scleral suture and the large sliding conjunctival flap—gives two elements needed in cataract incision closure; namely, guarding against vitreous loss and against slow reformation in

the anterior chamber with its accompanying complications. A film showing the above operative procedure in six cases was presented.

Discussion. Dr. William Zentmayer said that, in looking up the literature for Dr. Decker, he had found that this procedure had been employed in cataract operations by Kuhnt.

Kuhnt makes a large conjunctival flap, as described by Dr. Decker, and, in addition, makes a horizontal incision well up in the cul-de-sac, which allows greater freedom in bringing down the flap and, therefore, better coverage of the wound than can be obtained without that incision.

Dr. Edmund B. Spaeth said that he had had the pleasure of seeing Dr. Decker's film with him at his home so that Dr. Decker knew, at least in part, what he was about to say for they had had a discussion at that time. It seemed to Dr. Spaeth that too much stress had been laid upon necessity for firm closure. Dr. Decker's two lateral sutures with the sliding conjunctival flap will give this under all but extraordinary circumstances. At the same time, the conjunctival flap should seal off the anterior chamber. Dr. Spaeth agreed with Dr. Decker as to the necessity for closing the anterior chamber promptly. For years he had used the conjunctival flap closure on all cataract operations in one-eyed individuals. Nonformation of the anterior chamber, if it continues for more than two or three days, can cause serious consequences. Dr. Decker's beautiful film presents that, without any possible difference of opinion, in a most conclusive manner.

Dr. James S. Shipman said that he, also, would like to congratulate Dr. Decker on this beautiful presentation of a very interesting subject. From the pictures that had been shown he could not see the necessity for using any suture. The way those cataracts were delivered and the

way Dr. Decker had his patient's eyes stay so still was beautiful to see. Dr. Shipman asked what kind of anesthesia had been used. In every cataract, that was shown, the operation was done very skillfully and with very little trauma. Certainly, so far as could be seen from the picture, there was no danger of immediate loss of vitreous.

The only excuse for a suture in these cases would be for the second reason—that of delayed closure of the anterior chamber. In Dr. Decker's technique, as nice as it was, Dr. Shipman did not once see where he replaced the iris pillars. What happens to these? Were the pupils dilated with atropine or homatropine? What drug was instilled at the first dressing? Was it atropine or not? These, are important points that have a great deal to do with the closure of the anterior chamber and, if the pillars are not replaced, they are going to be incarcerated to a certain degree and lead to a slow closure of the anterior chamber. Dr. Shipman said that he believed that there was no necessity for using atropine for the first dressing when there has been a good intracapsular extraction, as in all of these cases. Atropine is necessary in an extracapsular extraction where there is a lot of cortex, but, when a complete intracapsular extraction has been performed, there is no necessity for it. Certainly, there is no necessity for atropine until the anterior chamber has reformed and, in Dr. Shipman's experience, the major portion of them do reform within 24 to 48 hours after operation. He thought that a large conjunctival flap was a great help in getting the anterior chamber to reform and eliminated one of Dr. Decker's objections to cataract extraction without a suture; namely, the second objection—slow closure of the anterior chamber.

Dr. Shipman said that he had not come to believe that sutures were necessary for safe cataract surgery. He said that he

could do a better operation without them, and that he did not use them except on very rare occasions. He used one the preceding week in an eye that he knew had vitreous in the wound which was the result of a basal iridectomy. The man was a very poor patient, and his facial nerve was not blocked. Later, the lens had to be removed. Dr. Shipman felt that vitreous would present itself when he made the section. The iridectomy incision was enlarged slightly; then, three corneal-scleral sutures were inserted before the section was completed. In spite of this, vitreous was still seeping from the wound 10 days after extraction. Dr. Shipman said that he could not be convinced that corneal-scleral sutures or conjunctival sutures, as described by Dr. Spaeth in his discussion, would keep the vitreous in when it was going to come out. If vitreous is going to be lost, it will be, regardless of any suture. He still felt that a well-made corneal section, with a good conjunctival flap, was the best operation for cataract extraction.

Dr. P. H. Decker (closing) said that he wished to thank Dr. Shipman for his remarks, but he still felt sutures were necessary, at least in his hands. In regard to replacing the iris pillars, this was always done when there was any question of incarceration. He did not show this step in order to conserve film; however, he might add that he did not always insert an instrument into the anterior chamber after the extraction in order to replace an imaginary incarceration, as he felt that there was danger of inadvertently rupturing the hyaloid membrane by doing any unnecessary intraocular instrumentation after the extraction of the lens.

George F. J. Kelly,
Secretary.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

January 7, 1946

DR. MAURICE L. WIESELTHIER, *presiding*

WAR SURGERY IN OPHTHALMOLOGY

DR. SIDNEY FOX said the title of his paper was correct only in so far as it applied to the eye center to which he was assigned. This was one of the nine eye centers set up when it became apparent, after the Normandy invasion, that the 65 general hospitals could not handle the large number of casualties. At the peak of activity 75 to 80 percent of the admissions were surgical cases. Later, about 50 percent were medical eye cases, half being nonspecific iridocyclitis; the others included optic atrophy, keratitis, and other metabolic disturbances in released prisoners of the Japanese. The first 500 operations performed in 1944 were divided as follows:

Defects (plastic repair)	235	47.0%
Secondary orbital implants	60	12.0%
Enucleations	47	9.4%
Cataracts	44	8.8%
Intraocular foreign bodies	27	5.4%
Muscles	25	5.0%
Glaucoma	15	3.0%
Retinal detachment	13	2.6%
Lacrimal operations	7	1.4%
Miscellaneous	27	5.4%

Operations after these 500 showed a greater proportion of plastic and lacrimal-sac operations. As a time-saving procedure for orbital implants, the use of purse-string sutures was abandoned, and two crossed-mattress, chromic sutures for Tenon's capsule with a running conjunctival silk suture were substituted with satisfactory results.

There were some senile cataracts, but most cataracts were traumatic and were usually removed by linear extraction. A

spatula, bent like a hook, was devised to slip under the iris to separate synechiae in the 11- to the 1-o'clock positions to eliminate the need for iridectomy in these cases.

Most intraocular foreign bodies were removed overseas. In the few cases which were seen, it was found that the giant magnet had little advantage over the hand magnet. The prognosis in these cases should be guarded, as in some eyes from which foreign bodies were successfully extracted with subsequent clearing, there occurred a late degeneration. A pars-plana approach was favored. In some of the cases, air was injected after the extraction but, in many of these cases, fibrous tissue resulted in multiple air pockets.

The traumatic-muscle cases were not operated upon until a year after the injury. Many of the squint operations were for strabismus present before entering the army. Many of the glaucoma cases were not the result of war trauma. Surface cyclodiathermy proved a satisfactory operative procedure. Ten of the 13 retinal-detachment operations listed were nontraumatic. A combined surface and penetrating diathermy operation was performed. Many of the patients had great damage to their lacrimal sacs, nasal, ethmoid, and lacrimal bones, and the number of these cases increased later in 1944 and in 1945. Lipiodol was injected to show the extent of the trauma. A large number of dacryocystorhinostomies were performed.

Possibly the most characteristic type of case resulted from burns after gasoline explosions in airplanes and tanks. Plastic repairs were required in these cases for loss of skin, shortening and loss of the eyelids, ectropion, and so forth. Powder burns were also common, and powder particles were found in tremendous numbers in the skin and eye.

To remove deeply embedded corneal foreign bodies a V-shaped incision was made in the cornea—the apex toward the center, the foreign body lying between the two arms—and a beveled flap was cut down from the apex. When the foreign body was approached, the flap was reflected, the foreign body removed, and the flap patted back in place. Only once was the cornea penetrated with loss of aqueous but with no adverse result.

Slides were presented illustrating the various types of cases.

VISUAL PROBLEMS IN AVIATION

MAJOR ERNEST A. PINSON (MC) said that associated with the operation of the Army Air Forces was the necessity for development of equipment which will measure or enhance certain visual functions used in flying. In certain instances, considerable research went into the development of such equipment to insure that it would serve the desired purpose when development was complete. Some of the equipment developed in the A.A.F. during the war years to solve certain problems relating to vision were: (1) The A.A.F.-Eastman Night Vision Tester for rapid testing and classification of large groups of flying personnel with respect to night vision. (2) The Radium-Plaque Night-Vision Tester, a small compact instrument which could be carried in a flight surgeon's kit, for testing at the squadron or group level. (3) Red goggles for wear in lighted ready rooms to keep the eyes of personnel dark adapted so that immediate efficient use of the eyes could be made outdoors at night; for example, in case of a hurried take off on an interceptor mission. (4) Anoxia demonstration charts to show flying personnel the reduction in visual efficiency at night due to anoxia, even at low altitudes, in case supplemental oxygen is not used on night flights. (5) Colored plastics for use

in blind flying training. This includes a combination of yellow or amber plastic over the windscreen plus blue-lensed goggles worn even in sunlight; whereas, the instructor who wears no blue goggles can see clearly through the yellow windscreen. (6) Special lenses for goggles and sun glasses. Amber lenses are used for haze penetration; graded-density lenses for scanning directly into the sun; rose-smoke lenses for glare protection and haze penetration.

Discussion. Dr. Howard Agatston said that Major Pinson's ingenious test for dark adaptation measures the degree and not the rate of adaptation. The time factor is not taken into consideration, and there is not always a high correlation between the degree and rate of dark adaptation.

Night blindness is a military medical problem from several standpoints. Shortly after the liberation of American soldiers from Nazi prison camps in April, 1945, it was noted that a large proportion of the men had nocturia and were unable to find their way to the latrines. Not having access to a biophotometer, 82 liberated soldiers were tested by exposing them to an X-ray viewing box for 10 minutes, then measuring the time it took for them to recover fully a 30-degree field either on a tangent screen or on a campimeter, in a dimly lit room. About 50 percent of this group, examined approximately one month after liberation, had prolonged adaptation times. Several malingerers showed normal rates of dark adaptation with concentric constriction of the field to 10 or 15 degrees, and there was little or no increase in the field taken in ordinary daylight. Perhaps the field of usefulness of Major Pinson's test could be widened by the addition of a time element and by its further adaptation for use in the diagnosis of malingering.

Major Pinson said that in a night-vision test, interest was in measuring the

ability of the man to see under conditions which prevail at night. A good test must be correlated with this function. There is only a fair correlation between the rate of speed of dark adaptation and the terminal-rod threshold. The correlation between terminal-rod threshold and ability to see at night is very poor.

A satisfactory test for catching malingerers on dark-adaptation or night-vision tests has been developed. It depends on optokinetic nystagmus over which the examinee has no voluntary control. It has not been designed for field use but could be set up in a laboratory or hospital somewhat behind the front lines.

EXPERIENCES IN THE PRACTICE OF OPHTHALMOLOGY IN THE ARMY

DR. FREDERICK H. THEODORE said that in military ophthalmology routine classification work is of great importance. The military ophthalmologist tends to forget that different persons with the same refractive error may see differently without glasses, especially myopes. Furthermore, there is an unfortunate tendency, particularly among less experienced examiners under pressure, to call a soldier a malingerer without obtaining positive proof by means of malingering tests, just because no cause for the impairment of vision can be discovered. In this connection, the frequency of amblyopia of unknown origin should be emphasized. In a survey of 190,012 soldiers undertaken by the author and his coworkers, 10,532 were found to have impaired vision in at least one eye. In 23.82 percent or 2,509 of these men, poor vision had to be classified as of unexplained amblyopia.

Certain eye conditions that appear of minor significance in civilian life assume much greater importance in the Army, especially under field conditions. Outstanding among these conditions is night blindness. Cases of minor-degree night blindness, without obvious retinal find-

ings, are often disregarded. As a result, there may be malassignment of the individual soldier with serious consequence. Vernal catarrh is another condition which can become intolerable in warm climates. It is generally overlooked on induction. Hay fever falls in the same category. Men become sensitive to allergens that never bothered them clinically before.

Some eye conditions seem to be encountered more frequently in the Army than in civilian practice. These include primary, meningococcic conjunctivitis, nine cases of which Dr. Theodore had seen, and exudative choroiditis, which occurred in the younger soldiers. The importance of routine bacteriologic studies in acute conjunctivitis in the Army must be stressed. In heat stroke, retinal hemorrhages were seen in two cases. The local use of penicillin has resulted in so many allergies that its indiscriminate use is to be avoided.

In analyzing unpublished data concerning 41,000 men examined for aviation-cadet training, the inadequacy of the Howard-Dolman depth perception test was obvious. The value of routine screen and cover tests and testing of ocular motility was indicated by the uncovering of many cases of tropisms, otherwise overlooked and not picked up by routine photometer measurements.

REVIEW OF CONTRIBUTIONS OF WORLD WAR II TO OPHTHALMOLOGY

DR. RICHARD J. HESSBERG pointed out that modern ammunition with its high explosive force produces extensive damage to eyes, orbit, face, skull, and brain; therefore eye injuries are often combined with head injuries.

All ophthalmologists recommend sending eye injuries to eye departments at rear hospitals as soon as possible. At the first-aid station, only cleaning and dressing should be done. Most of the eye injuries resulted from mine explosions.

They produced perforating wounds with or without intraocular foreign bodies. Direct suture of corneal wounds is the method of choice. Only gaping perforations need conjunctival flaps. For the extraction of the foreign body a delay of 48 hours seemed to be less dangerous than lack of skilled care. Successful extraction is based on accurate localization with X ray. The multitude of foreign bodies and the overwhelming majority of small nonmagnetic ones made the posterior route the method of choice for the extraction of magnetic and nonmagnetic fragments. Severely damaged eyes should be enucleated with the least possible delay. Only in cases of purulent endophthalmitis is evisceration more advisable.

Blast effects are a new type of war injury due to detonation of high explosive bombs. The blast waves cause serious damage to the interior of the eye, rupture of the sclera, even complete loss of the globe.

Orbit and face were often injured, together with the eyes, by mine explosions. Important complications are injuries of nose and sinuses which menace the eyes and opening of the skull and which may be dangerous to life. Complete exenteration of the orbit and careful examination of nose and sinuses are necessary to protect the dura mater, if cerebro-spinal fluid is secreted from orbit or nose. An early spectacle-shaped hematoma of the lids is caused by multiple fractures of the orbit.

Severe burns of face and eyelids were produced by high explosive and incendiary bombs and by burning gasoline. The extensive defects of face, socket, and eyelids require skillful plastic reconstruction. The ophthalmologist doing reconstruction work has to choose the simplest procedure within the shortest time for the best restoration of form and function.

Discussion. Dr. Morris Davidson said that the New York Society for Clinical Ophthalmology ought to be congratulated

for starting this initial survey in the lessons of the war for the ophthalmologist and for the community. This was only the first installment of the survey of ophthalmic literature. The term "contributions," implying a constructive purpose, he felt should be discarded. Wars do not make any contributions to society. They only teach lessons.

Leon H. Ehrlich,
Secretary.

SOCIEDAD OFTALMOLOGICA DE MADRID

January 25, 1946

SUBRETINAL CYSTICERCUS

DR. MARIO ESTEBAN described a case of subretinal cysticercus (with presentation of patient). In this case, the first manifestation was an iridocyclitis. In the course of this condition it became possible to make out the presence of a subretinal cysticercus in the form of a smooth and transparent vesicle located in the infero-external sector.

The clinical aspect of the cysticercus was described, with discussion of the differential diagnosis of retinal detachment, choroidal tumor, and so on. As to treatment, surgical extraction must be attempted as early as possible, before the mechanical action of the presence of the cyst and the toxicoanaphylactic action of the parasite lead to greater changes in the eye, and before the cysticercus migrates into the vitreous, where its seizure would be more difficult and dangerous.

Discussion. Dr. G. Diaz García del Viso congratulated Dr. Esteban on his study, and referred to a case treated primarily with five or six sessions of radiotherapy without any change on the part either of

the parasite or of the eye. The speaker had read later that radiotherapy had no action on cysticercus. Upon a suggestion by Dr. Basterra Santacruz, the cysticercus was killed by electrocoagulation, but after eight or ten days there began an iridocyclitis with hypopyon and marked pain, which made enucleation necessary.

The speaker agreed that the best treatment was surgical intervention with extraction of the parasite, in view of the certainty that even though diathermy killed the parasite it was sure to be followed by allergic reaction or by toxic action of the products of disintegration of the dead parasite.

CYSTIC FORMATION IN A PTERYGIUM

DR. MARIN AMAT showed a clinical case of cystic formation in a pterygium, and another case of melanotic tumor of the iris. He would later make these cases the basis of other communications.

FOREIGN BODIES OF THE ORBIT

DRS. M. MARIN AMAT and M. MARIN ENCISO stressed the importance of exact localization and interpretation of foreign bodies of the orbit (with projections). A patient with an extraocular foreign body of the orbit (from birdshot, while hunting), showed displacement of the radiographic shadow during movement of the eye, ecchymosis of the bulbar conjunctiva exactly corresponding with the wound of palpebral penetration, and hemorrhage into the vitreous. The authors called attention to the importance of differential diagnosis between intraocular and extraocular foreign bodies by means of good radiographic technique and perfect physiologic interpretation.

The symptoms were modified by the fact that the shot had glanced off of a stone, diminishing the force of penetration, and the shot remained incarcerated in the fibrous tissue of the adherent bor-

der of the upper lid, producing merely contusion of the eyeball and secondary hemorrhage. The patient had been looking down at the time of the injury. In the normal position of the open eye the foreign body would have lodged inside the orbit and would have escaped digital exploration. In lateral radiography in two exposures (looking up and looking down), the upper lid would follow the movements of the eyeball and thus produce a double shadow on the radiographic plate, instead of a single shadow. This, and a radiographic technique with the contact glass, would establish the true differential diagnosis.

Discussion. Dr. Gregorio Diaz Garcia del Viso said that, of the different methods of localization of intraocular foreign bodies, there are few which determine whether the foreign body is or is not intraocular so distinctly and conclusively as in the case presented by Drs. Marin Amat and Marin Enciso. Either of the methods described (contact glass, Casanova's ring, or that of Vater) are good and usually avoid uncertainty; but in other cases a distinction between extraocular and intraocular is difficult.

Closing, Dr. Marin Amat said that Comberg's contact-glass method was excellent, since the so-called geometric procedures, beside being complicated, required especial apparatus not always available. Injection of air into Tenon's capsule may mask the presence of the foreign body and is not always free from danger.

are, however, lesions of the canaliculi in which this operation cannot be performed for the very nature of the inflammation of the sac (tuberculosis and so on) contraindicates it. On the other hand, cases are encountered in which, in spite of the most perfect technique, the operation fails. In all such cases, having once eliminated lacrimal suppuration, the operation indicated is that of removing the lacrimal gland. The speaker has abandoned extirpation of the gland on account of the dry conjunctivitis which it produces. More recently he has used injections of alcohol, which, however, are inconstant in their action and have rather disagreeable consequences. Diathermocoagulation of the palpebral gland and of the excretory passages of the orbital portion is a harmless and often very successful operation. To avoid later dry keratoconjunctivitis, it is necessary to exclude those cases in which there exist conjunctival alterations of such a nature as to suggest failure of function of the accessory lacrimal glands, as found, for example, in trachoma. Also to be kept in mind are Sjögren's syndrome (menopause, dryness of the mucosas, rheumatic troubles, and so on). Discussion by Drs. Marin Amat and Esteban.

Dr. William H. Crisp,
Translator.

SOCIEDAD OFTALMOLOGICA DE MADRID

SCIENTIFIC SESSION

February 22, 1946

CONSIDERATIONS CONCERNING LACRIMATION

DR. GARCÍA MIRANDA reviewed the various forms of therapy used for dealing with epiphora. He then insisted on the usefulness of dacryocystorhinostomy, which he considered the operation of choice in cases of dacryocystitis. There

NEVUS FLAMMEUS AND GLAUCOMA

DR. CASERO (from the Clinic of Prof. García Miranda) said that it is interesting that localization of nevus follows the distribution of the branches of the sensory nerves, that is of the nerves of vegetative life. There are two types: (1) The type in which the nevus is accompanied

by late appearance of a simple glaucoma; (2) the type in which the nevus, from birth, accompanies hydrophthalmos. As regards the cases with glaucoma, these are now regarded as due to telangiectasis in the ocular fundus, especially the choroid; although existence of a nervous factor cannot be excluded. The radiologic appearance of this condition was described by Weber in 1923, including the appearance of parallel curved lines of calcification corresponding to images of the cerebral convolutions, with deposits of lime in the boundary between the gray matter and the white matter. The speaker described a case of nevus flammeus of the first branch of the trigeminus of the left side, with ocular hypertension of 60 mm. Hg reduced to 45 mm. under pilocarpine. The disc was atrophic but did not show glaucomatous excavation. The peripheral field was normal but there was an absolute central scotoma. There were changes in the pyramidal tracts of the brain and also a slight mental debility. There were dilatations of the vessels of the diploe, without Weber's calcifications.

The discussion was led by Drs. Mario Esteban, Marin Amat, and García Miranda.

CONGENITAL ECTROPION OF THE UVEA

DR. BARAHONA (from the Clinic of Prof. García Miranda) described such a case in a girl, aged eight years. The ectropion covered a large part of the iris stroma. As seen under the slitlamp, the iris was perfectly formed, reacted normally to light and convergence, and the eye showed otherwise no anatomic or functional anomaly.

Discussion. Dr. Mario Estaban called attention to differential diagnosis from heterochromia or pigmented nevus of the iris.

OCULAR LESIONS FROM VOLATILE SOLVENTS

DR. GARCÍA MIRANDA described the danger to the eye in occupations apparently harmless, with especial emphasis on ocular lesions from volatile solvents. These substances have metallic action, are irritating to skin and mucosa, and have specific action on the liver, the kidney, the heart, the blood, and the nervous system. In the course of industrial development, such substances are used to a remarkable degree in the making of lacquer for furniture, leather, shoes, artificial silks and gems, in the cleaning of various articles of wear, and in various parasitocides.

In cases of retrobulbar neuritis, the cause of which cannot be determined, it is to be remembered that central scotoma with a variable ophthalmoscopic picture may be the only clinical expression of poisoning by one of these preparations. The speaker's comments were based upon a case in which the left eye showed a post-neuritic optic atrophy and the right eye a simple atrophy with a final picture of retrobulbar neuritis. The patient had worked for 23 years with one such product known as "rudol Michelin." Most persistent clinical investigation did not show any other etiology than presumed intoxication by such a substance. Discussion by Dr. Mario Estaban, with special regard to industrial compensation.

Dr. William H. Crisp,
Translator.

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THE HEED OPHTHALMIC FOUNDATION

A generously endowed trust fund has recently been established by Mr. and Mrs. Thomas Heed of Chicago. Its purpose is to provide fellowships to qualified individuals who have completed their residencies in Ophthalmology, in order that they may continue their advanced studies primarily in ophthalmic surgery. The conditions are liberal and there are very few restrictions. The successful applicant, or

applicants, will be chosen by a board of directors composed of five ophthalmologists. He will hold the fellowship for a year, or longer if the board is so inclined. The fellowship is limited to American citizens for training in the United States of America. One or more fellowships, depending on the applicants and the availability of places suitable for such advanced training, will be granted each year, at the discretion of the board. The secretary is Dr. M. Hayward Post of Saint Louis.

The creators of the fellowship have rendered a great service to ophthalmology and to the people. The training of an expert ophthalmologist is one of great responsibility and importance. It requires time, experience, and material. Many ophthalmologists are doing eye surgery, but there are relatively few who are outstanding in this meticulous field. There is far too much surgery of mediocre quality being done. This is, for the most part, the result of poor training and lack of opportunity. Many a promising ophthalmic surgeon has had to go into practice at the end of his residency, by force of necessity. He has had to achieve skill and proficiency the hard way, sometimes at a cost to his patients.

A year of further, advanced training under the watchful and paternal eye of a master, or number of masters, cannot help but be beneficial to the public and to ophthalmology. The time spent in the working out of particular surgical problems, research in techniques, observation, the assisting at and the performing of various operations under the direction of a preceptor cannot but be fruitful. To work, free of economic worry and pressure, with men who are outstanding in this field is an opportunity that is superb and without price.

There is a danger that this training might interfere with that of the resident and stifle his chances. This need not be so if the matter is carefully thought out and planned. Much depends on the preceptor and the inspiration that he gives to the Fellow, as well as to the opportunities that are at hand. The members of the board of directors who are experienced surgeons and teachers can be trusted to work out this problem satisfactorily to all concerned. In fact, the resident should benefit considerably by association with the Fellow; each could be of assistance to the other in the surgical workshop.

It may be said, too, that there is a scarcity of clinical material upon which to work and learn. This may be true in most places in so far as the numbers of patients are concerned, but teachers of ophthalmic surgery agree that it is quality and not quantity of workmanship that counts. If talented, one can become a safe, and perhaps excellent, cataract surgeon after the performance of 25 or so cataract operations done the right way. It also holds true that 100 operations done with little or no supervision, especially by a bungler, will leave the cataract surgeon no further along, except for a trail of more or less mutilated eyes behind him. The brutal German saying that "one can only become a surgeon after spoiling a hatful of eyes" is a false one.

Like other fields of endeavor where skill, training, artistry, and "the touch" count, ophthalmic surgery requires much of the man who would excel. He not only must be peculiarly endowed by nature with talent; he must also be inspired by example. He must have a good eye and a steady hand. He must be bold, yet tender. He must have the courage of a tiger and the touch of a butterfly. Above all he must have judgment.

He must develop versatility. There are many violinists but only one Heifetz. There are many fiddlers who can play nearly every piece of music fairly well in the first three positions, but none of these become violinists without further study, training, and practice. Exceptionally few develop the versatility required of a master of the art. There are many ophthalmologists who can do a good cataract operation provided everything goes well, but the possessor of versatility in cataract surgery has saved many an eye that, in lesser hands, would have ended in disaster. It is the function of a good teacher to teach and develop this art in the pupil. It is this type of training in the post-

residential stage that should be emphasized.

There are a number of foundations designed to take care of the patient after he becomes blind, even as the result of poor surgery. The Heed Ophthalmic Foundation is the first, however, planned against a specific source of blindness. In fact, it can be called a "Foundation to Prevent Surgical Blindness." For their generosity in providing the means to elevate the standards of surgical training and to further the development of surgical skills, the Heeds deserve the gratitude of all ophthalmologists.

Derrick Vail.

INSTRUCTION IN OPHTHALMOLOGY BY OPHTHALMOLOGISTS TO NONMEDICAL GROUPS

There has long been a difference of opinion as to whether or not the ophthalmologist would serve the public better by giving instruction to those who specialize in care of the eyes but who have not had the medical training that would qualify them to practice medicine.

The arguments pro and con are for the most part too obvious to need more than mention. On the "pro" side it is almost universally agreed that there will be a continuing use for the refractionist who has not qualified for the practice of medicine or surgery. For everyone who plans to perform refraction to have surgical training is absurd. Three fourths would have wasted their time because there is not now, and never will be, enough surgery for them all to become or remain qualified. Nevertheless, everyone who performs refraction should have a good medical background. Whether this is obtained by improving this part of the teaching in the independent schools of optometry or by associating them with medi-

cal schools, as is now the tendency, is another subject for discussion.

On the "con" side are such arguments as that these nonmedical refractionists will never have sufficient insight into the medical factors involved in refraction and that a full medical and surgical training such as is required by accredited medical schools is essential for intelligent ocular examination. The point is made that, with insufficient medical training, these refractionists invade further and further the medical field and that lectures and instruction by ophthalmologists can never be adequate. Furthermore, those on the "con" side contend that lecturing in optometric colleges gives recognition to non-medical refractionists that ophthalmologists should not encourage.

The heated and prolonged controversy over the optometric resolutions of the Section on Ophthalmology of the American Medical Association testifies to the difference of opinion on the entire subject. Realizing that this is so and recalling the previous difficulties about the resolutions earlier passed by the Section, the "Pros," in order to liberalize ophthalmooptometric relations to some degree, introduced the following resolution at the Section meeting in San Francisco in July: "Whereas, It is not contrary to the Principles of Medical Ethics as determined by the American Medical Association for members of the Association to disseminate information pertaining to matters of public health, such as cancer, diabetes, and venereal disease, by lectures, demonstrations, radio talks, pamphlets and conferences or other means to non-medical groups; and Whereas, Ophthalmic subjects, such as vascular disease, glaucoma, retinal disorders and optic nerve disease, considered as potential causes of blindness are matters of grave importance to the public; and Whereas, The prevention of blindness is one of the chief obligations of

ophthalmologists; therefore, be it Resolved, That the Section on Ophthalmology of the American Medical Association declares that it is entirely within the definition of medical ethics for its members to engage in lectures, demonstrations, the preparation of pamphlets and other measures suitable for the dissemination of information designed to prevent blindness and directed to any non-medical group."

This was passed unanimously and should be adopted when presented to the House of Delegates at its next session. What are the implications of this action of the Section in recognizing the value of permitting the ophthalmologist to give lectures to optometrists? Fundamentally, the resolution recognized the optometrist as a part of the visual program and that, as such, the better informed he is, the better it will be for the public. This goes even further and carries a deeper implication than this and one with which ophthalmologists may not agree. This is the recognition of optometry as a useful and honorable specialty. Why plan otherwise to help its members?

To fail to recognize optometry as an entity is sheer wishful thinking on the part of some ophthalmologists. The hostile attitude between the two groups is detrimental to each and above all to the public that is confused by the repercussions of the conflict. An understanding between the two is long overdue and this would probably have taken place years ago had ophthalmologists been permitted by medical ethics to confer freely with optometrists.

The aforementioned resolution when passed by the Trustees will go a little way toward breaking down the barriers, and free discussions, when possible, may help to delimit the fields of activities of oculists and optometrists. The resolution does not go far enough, but may do something to encourage better relationships.

Most optometrists want to refer as few patients as possible to eye doctors because eye physicians seldom refer patients to them and are sometimes remiss in sending the referred patients back to the optometrist. For this and other reasons, many optometrists wish themselves to conduct, whenever possible, the ophthalmic care of the patient and to consult directly with the internist; for example, in cases of diabetes, retinitis, and brain tumors. Optometrists hope to perfect themselves in diagnosis and many want to give orthoptic training. Most ophthalmologists believe that the optometrists' lack of a broad medical education prevents their having sufficient background to render them competent in the making of diagnoses. The difficulty of doing so is recognized by optometrists, and their leaders are constantly attempting to raise optometric educational standards. It is not inconceivable that their own demands will force such educational requirements in their group and that two or more years of medical training will be insisted on by them for optometric degrees. It may not be, and probably should not be, the same as that required of those who plan to practice in the medical or surgical fields of ophthalmology, but might well be broad enough to enable those who graduate from such schools to perform satisfactorily such functions as most optometrists wish to perform. In that case, the number of oculists may diminish, but this in itself may not hurt the public weal if the work is well done by others.

In brief, many optometrists desire to perform refractions, make fundus examinations, test visual fields, give orthoptic training, fit contact lenses, serve as consultants for medical practitioners, and to attain medical recognition of the title "Doctor." Some would eliminate ophthalmologists from all of the visual fields except the surgery and medical treatment.

The extreme ophthalmic point of view would be the elimination of optometrists from all fields and, on the other hand, no ophthalmologist would accept all of the suggestions of the most radical optometrists. Put in that light, the differences might seem insurmountable, but fortunately in our democratic state there is a certain amount of give and take and a willingness to see the other fellow's point of view. Some compromise in these visual matters is essential to public welfare.

The first step necessary is to make it possible for ophthalmologists to confer with optometrists without criticism. From there on, matters should not be too difficult. Leaders of both groups should meet without animosity, in friendliness, and on an equal footing and, bearing in mind primarily the visual welfare of the public, should iron out their differences. Naturally it will take a long time to eliminate all of the points of disagreement, but even this is possible and to make a good start in the right direction should not be hard. Most important is the point that coming to agreement is not a may, but a must!

Lawrence T. Post.

BOOK REVIEWS

HARVEY CUSHING, A BIOGRAPHY.

By John F. Fulton. Springfield, Illinois, Charles C Thomas, 1946. 722 pages, 150 illustrations, index. Price, \$5.00.

John F. Fulton, Sterling Professor of Physiology, Yale University, whose versatility matches that of his subject, has produced herewith a brilliant volume of biography that glows with admiration and affection for one of the greatest figures in medicine and surgery of all times. That this has been a labor of love and creative joy is obvious at the first thumbing of the book. Although an intimate friend of "the Chief," a close companion on many a fa-

mous occasion, and the literary executor of the Master, Fulton has written this splendid and vital work as objectively as was humanly possible for him to do. Throughout the book he refers to himself as "a friend" who said this or observed that, copying intentionally Cushing's own biographical method in writing the great *Life of Sir William Osler*. One cannot help but wonder whom J.F.F. has chosen to be his own literary executor and biographer, for surely the tradition that produced such magnificent biographies as "Osler" and now "Cushing" must be perpetuated and the torch handed on.

There are many physicians, surgeons, neurosurgeons, neurologists, and even ophthalmologists, for we honored H.C. (as Fulton calls him) by giving him the Herman Knapp medal from the Section on Ophthalmology of the A.M.A., in 1929, for his paper on the meningiomas that he presented before the Section, who will read this volume with great pleasure and profit. There will be countless medical students, house officers, residents, and internes who will try to take it apart to see what made the man tick, and some may even try to do back somersaults from hospital entrances throughout the world in emulation of the great man, trusting that some photographer may be present to snap the act for posterity.

It is not known whether or not Cushing was ever "analyzed" by a psychiatrist friend or foe to discover the driving force of his vital personality. He was fortunate in the choice of his forefathers, particularly so in his parents, for his father, made of stern stuff, still paid the freight of his extraordinary son until long past the usual age of paternal financial subsidy. Did he, realize in some prophetic fashion just what his son would do in life? Most doctor fathers of doctor sons want them to return as soon as training is over to help the old man in his work and speed

his retirement. Not so Dr. Henry Kirke Cushing, for if there were any parental objections to the long training program, the biographer does not make it clear.

A man of H.C.'s dynamic drive, ego, personality, and character could not but make enemies, most of whom were jealous perhaps, behind him in his march to the peak. He knew what he wanted and set out to get it, seizing the opportunities as they presented and squeezing the last ounce of juice from the fruit. His ruthlessness is lightly mentioned in the biography, but those who knew and recall him vividly to mind know how merciless he could be at times toward friend and foe alike.

The author of this review sat at his feet as a medical student and recalls many an occasion when this unpleasant trait of ruthlessness revealed itself in the classroom and operating theater. H.C. was a man possessed by a demon of perfectionism. His class-room humor could be and often was sardonic and sarcastic. He drove the students to despair in his quizzes by his remarks. Even his nephew Pat, was not spared these quips, and H.C. would turn on him like a tiger when the perfect answer was not forthcoming, as it almost never was from any of us. On other rare occasions, particularly when he was discussing and showing some of his collection of old medical books, all was sweetness and light, good humor and kindness. We did not know until after graduation what a great man this little devil really was, and perhaps it was presumptuous of us to expect anything else, worms that we were, but verbal scourgings and tongue lashings for our colossal and abysmal ignorance. But we learned much from this man and are grateful to have touched the hem of his operating gown in passing.

His iron character revealed itself most strikingly when, informed of his eldest son's tragic death in a motor accident, he

made the necessary arrangements by telephone for the bringing home of the body, and then went into the operating room where he calmly did a tedious and painstaking brain operation. Did his hand shake, or his heart turn sick, or his respiration increase, or his spirit falter? No one knows.

He was fortunate in the devotion of his wife who coped with his drive in life and surrounded him with every protective device she could, as if realizing that he did not belong to her or the children but to the world itself. One wishes that the author of the biography had devoted more space to the drama of this Spartan widow and her tribulations as wife of a genius.

There is much in the book of ophthalmic interest, particularly one gem. When on a visit to Lyons in 1900, H.C. called on Louis Dor. He said in his diary: "Dor is an ophthalmologist but such a one as the following description will relate. He took me to see a patient who had lost his cornea and ant. chamber from a hot iron. The man came to Dor after 8 days just as the slough had separated. The lens fell out and iris was prolapsed. Dor replaced them, covered the wound with a graft of a rabbit's whole cornea which he sewed in place and covered with one of the thin glass arrangements for astigmatic eyes. I saw the man 8 days after this—graft taken—slightly opaque. Probably will have vision." Did the graft really take? There is doubt about that for ophthalmic literature is silent, as far as I know, about this remarkable case. Had this operation taken place in the United States in the year 1946, the newspapers would have told us everything except the end results too, you can be sure.

In 1911 Cushing "persuaded Clifford Walker of the present graduating class (at Hopkins) to stay and work on ophthalmological problems in the Hunterian Laboratory and in the hospital next year. I

hope he will make good." Walker did make good with Cushing as is well-known, for when the latter moved on to Harvard he took Walker with him and used him to study the perimetric deviations in brain-tumor lesions particularly those of the pituitary. Clifford Walker remained with him for some time and then moved out to the West Coast returning periodically to the Brigham Hospital to check, at H.C.'s request, the perimetric procedures. One wonders why Walker left and why he discontinued to a large extent his interest in perimetry, unless it was his great absorption in the problem of retinal detachment. Incidentally, Walker rendered an unconscious disservice to ophthalmology, for Cushing, and his pupils and his followers, seldom, if ever, relied on an ophthalmologist's perimetry, preferring to do it themselves, even to this day. Surely, there were ophthalmologists in Boston capable of taking an accurate field of vision, sparing Walker a long trek East. This is a curious thing, and not even hinted at in the biography. Is there an untold story here of animosity to Boston ophthalmologists? I think it to be but another manifestation of the perfectionist wanting control over everything that related in any way to his field, and jealously guarding his prerogative.

This book has given such pleasure in its reading that one is reluctant to put it down for within its pages are revealed the life's activities of a man of his own time, who made his own time through hours and hours of meticulous, painful work in the library, laboratory, wards, and operating room. He seized Time by the forelock and made him do his bidding. With malevolent and dictatorial charm he wove the fabric of his long life into a cloth of gold of priceless worth. His keen eye, skilled hand, and trained brain founded a new school of surgery. His influence will be ever felt, like the visible light of a star that perished

thousands of years ago. This little man of steel sinews possessed such vital force that the storms of nature and human ills buffeted against him in vain until the very end. His life belongs to the world and to humanity and we have much to learn from him. We are grateful for the glimpse of an epic life that J.F.F. has so skillfully given us.

Derrick Vail.

WHY PUPILS FAIL IN READING.

By Helen M. Robinson, Director of the Reading Clinic, University of Chicago. University of Chicago Press, 1946. Price, \$3.00.

Approximately the first half of this book is a comprehensive review of the literature. It is unfortunate that the author was unable to include the more recent publications, probably due to the difficulty and delay in getting material published immediately.

The remainder of the book deals with the findings which are present in 30 selected cases of reading difficulties. An extensive investigation was made by various specialists in their respective fields to include psychometric and educational examinations, social history, psychiatric studies, pediatric examinations, neurologic examinations, visual examinations, examinations of hearing, speech examinations, and endocrine examinations.

In conferences after evaluating and correlating the findings, the patients were classified by the way of a summary: (1) Anomalies found by the individual examiners. (2) Factors considered important by the group. (3) Probable cause.

The general approach in the remedial work was to begin with the symptoms which were considered as the primary causes and postpone the attempt to correct the various other factors as presented. Unfortunately, due to circumstances be-

yond control, the author was unable to make a complete analysis of many of her cases. It was therefore impossible to demonstrate the growth curve of the entire group. As demonstrated in many of the cases, it was difficult to get satisfactory results by treating only one factor which was considered to be the primary cause, rather than by treating concurrently the entire group of symptoms as presented.

In general, this thorough piece of work on the problem of reading difficulties, like all similar work, opens more problems than it solves. This book should be available to all persons interested in the problem of reading difficulties.

George E. Park.

CORRESPONDENCE

CONTUSION CATARACT OF THE ANTERIOR LENS CAPSULE

Editor,
American Journal of Ophthalmology:

I have just read Dr. Herbert F. Sudranski's interesting paper upon "Contusion Cataract of the Anterior Lens Capsule" (*American Journal of Ophthalmology*, 1946, volume 29, October, page 1281). His explanation of this "new" form of cataract is very intriguing, but I am afraid that this exhaustive study in intraocular dynamics is quite out of order since there is no doubt whatsoever, either from the description or from the photograph, that he is dealing with the extremely characteristic "Sunflower of Chalcosis Lentis," or the so called "Sonnenblumstar." The photograph is so typical that I am enclosing one of my own—a typical sunflower cataract, in order to accentuate the resemblance. Furthermore, I wish to refer to an article written in the *Archives of Ophthalmology*, 1944, volume 32, July, pages 63-65, in which this type of lens opacity was photographed. In this article

the technique of photography for such a cataract was described and, since the article dealt with "Chalcosis Lentis," such a



(Rosen). A typical sunflower cataract.

possibility should have occurred to the author.

It would appear that some retraction of the statement, "This lenticular opacity appears to be a unique variety of traumatic cataract not yet reported in the ophthalmic literature," is in order for this lens change is far from "unique."

Once having assumed that this is the sunflower cataract of Copper, it is not difficult to understand: (a) the biomicroscopic picture—that is, "complete reproduction of the circular sphincter muscle fibers and the radial pattern of the iris—on the anterior capsule of the lens—in faint, grayish-white markings," (b) the vitreous disorganization, (c) future course of the foreign body.

I trust that this brief note will be of some small value in maintaining the high caliber of the *Journal* and at the same time will be of some value to those young men who have not been fortunate enough to observe the "sunflower cataract" under the slitlamp.

(Signed) E. Rosen,
Newark, New Jersey.

Editor,
American Journal of Ophthalmology:

The photograph (minus data) sent to you by Dr. Rosen of Newark, New Jersey is, indeed, striking in its likeness to my case of contusion cataract recently published in the Journal. I am, however, unable to agree with Dr. Rosen that my case is actually one of sunflower cataract due to chalcosis.

Dr. Rosen referred to an article published in the Archives of Ophthalmology, July, 1944, which proved to be a case report of chalcosis authored by Dr. Rosen. The illustration of the sunflower cataract in that case bears only superficial resemblance both to the photograph sent to you by Dr. Rosen and to my own case. The first footnote in this article refers to a publication by Cordes and Harrington in the Journal, 1935, volume 18, page 348, which gives the following description of the typical sunflower cataract of chalcosis:

"The characteristic picture of chalcosis, as a rule, begins to appear several years after the introduction of the foreign body. There is present on the lens a disciform opacity occupying the pupillary area. It is greenish gray in color and rather metallic in appearance. In marked cases, the color may be a definite green. The edges of the ring are often serrated, with lines radiating to the periphery of the lens."

In his reported case, Dr. Rosen de-

scribed the cataract as "bluish green" or "aquamarine" in color. Such descriptions of the sunflower cataract of chalcosis that I have been able to find, similarly describe it as discoid in shape and of metallic color. Furthermore, chalcosis is found almost exclusively in cases of accidents involving ammunition (as in Dr. Rosen's case), and the development of chalcosis is concomitant with absorption of the foreign body.

My case of contusion cataract showed no evidence of a foreign body of copper. It was not a case involving an accident with ammunition. There was X-ray evidence that absorption of the foreign particles had not occurred. The cataract, upon the anterior lens capsule, in neither shape nor color, resembled the classic description of the sunflower cataract of chalcosis. There was no evidence of chalcosis of the cornea or other degenerative change due to the toxic effects of copper.

While I am unable to concur with Dr. Rosen's opinion of the significance of my case, I am deeply grateful for his having called to my attention a second case of contusion cataract, for surely a penetrating injury of the eyeball with a foreign body of copper should prove to be as efficient as any other in effecting such a lesion of the anterior lens capsule.

(Signed) Herbert F. Sudranski,
Indianapolis, Indiana.

LESLIE DANA MEDAL*

PRESENTATION TO HARRY S. GRADLE, M.D.

BY

CONRAD BERENS, M.D.

Mr. Chairman and Friends of Harry Gradle:

It is particularly fitting that the Saint Louis Society for the Prevention of Blindness should have selected the time of a meeting of the American Academy of Ophthalmology and Otolaryngology for the presentation of the Leslie Dana Gold Medal for outstanding work in the cause of preventing blindness. In the first place, every woman and man here not only is a friend of Harry Gradle but loves him because of respect for him personally and in appreciation of his work and his numerous activities, most of which had Prevention of Blindness implications.

Dr. Gradle or "Harry," as he is affectionately called by every member of the Academy, has been indefatigable in his work for this Society, and the postgraduate educational program and the Home Study Course have been important factors in educating ophthalmologists in this and other countries. His constant efforts to educate ophthalmologists have added new methods of prevention and treatment of eye disorders which undoubtedly have prevented much blindness.

Because of his researches, his writings, his teachings, his organization of the Pan-American Association of Ophthalmology, his imagination, and stimulating influence in conducting the affairs of his many activities, he has been a great leader in the Prevention of Blindness movement. No ophthalmologist today more richly deserves the honor of being awarded the Leslie Dana Medal. It is my privilege, on behalf of the Saint Louis Society for the Prevention of Blindness and The Association for Research in Ophthalmology, to present the Leslie Dana Gold Medal for the Prevention of Blindness to Dr. Harry S. Gradle. In his absence, because of illness, the medal will be received by Mrs. Audrey Hayden Gradle, who is equally outstanding in Prevention of Blindness activities. May I read the inscription?

"Let the light remain to Harry S. Gradle, distinguished ophthalmologist and teacher, ardent worker for saving sight."

Mrs. Gradle, will you take this medal to your husband with our deep love and fondest wishes for his speedy recovery?

* Presented at 1946 Chicago meeting of the American Academy of Ophthalmology and Otolaryngology.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
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| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
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| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

9

CRYSTALLINE LENS

Orr, H. C. Ray Cataracts. Trans. Ophth. Soc. U. Kingdom, 1944, v. 64, pp. 249-252.

Ray cataract, a term applied to lenticular opacities commencing in the posterior layers of the lens include the cataracts of glass blowers, puddlers, chain workers and those induced by ultraviolet and infrared rays, Roentgen rays, radium, lightning, and electric flash.

The author quotes Butler who stated that "the presence of lenticular opacities and of reduplication of the posterior capsule are not in themselves pathognomonic of glassblowers' cataract, but when, in addition, the slitlamp shows some detachment of the zonular lamella then the surgeon may go into the witness box and swear that the condition present is due to heat radiation and to no other cause." The incidence of the disease is less than it was 25 years ago owing to improved methods of work.

Such a cataract may develop within three months after operation for de-

tached retina when the diathermy point has been placed less than 13 mm. from the limbus. Presumably degenerative changes in the ciliary body induced by heat interfere with the nutrition of the lens capsule. Beulah Cushman.

Pignalosa, Giuseppe. The oxidation of some fatty acids and esters of fatty acids from the lens of guinea pigs on scorbutigenous diet. Boll. d'Ocul., 1944, v. 23, Oct.-Dec., pp. 243-256.

In 63 percent of guinea pigs kept on such a diet for 18 to 23 days, small punctiform anterior or posterior cortical or perinuclear opacities appear. These lenses can oxidize fatty acids or esters like many other tissues can. (Bibliography.) Melchior Lombardo.

Poyales, A. The Smith operation. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, June, pp. 456-464.

Poyales believes that the Smith technic is being unjustly discarded, and that it has definite advantages in selected cases. The technic is described in detail, and intumescent cataract considered its chief indication. It is con-

tra indicated in high myopia, and in small cataracts in old people, in whom the eye becomes very soft after the section. In contradistinction to other methods of cataract extraction, marked hypotension is not desirable with this technic. The author attributes complications to faulty technic.

Ray K. Daily.

Poyales, A. A modification of the Smith operation. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, June, pp. 464-466.

The modification consists in delivery of the lens without tumbling. Poyales compares this delivery of the lens to the escape of a cherry kernel, when the cherry is squeezed by the fingers. The role of the fingers is exercised by a hook and the posterior lip of the incision. The hook is applied at the lower third of the cornea, and pressure exerted upwards and backwards, at an angle of 45 degrees with the optic axis. Poyales insists on extraction of the capsule after the lens has been delivered extracapsularly because of accidental rupture of the capsule. Considering the state of opacification in which lenses are extracted today, an extracapsular extraction is, according to Poyales, a surgical absurdity.

Ray K. Daily.

Reynolds, J. S. Cataract extraction under sodium pentothal. *Minnesota Med.*, 1946, v. 29, July, p. 700.

The author reports 100 consecutive cataract extractions under sodium pentothal without any unsatisfactory results. The eye is very much at ease, there is good lid relaxation, lid retraction is perfect, and there is no need for conversation with the patient. Dilation of the pupil is almost complete. The

patient is quiet when he leaves the operating room and remains so from one half to four or five hours.

John B. Hitz.

Ribeiro, Rufino. The history of aspiration in cataract extraction. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, June, pp. 434-447.

Ribeiro traces the application of suction in cataract extraction from Tsabet Ben Gorra, who lived in Irak in the ninth century to Barraquer's modern procedure. For successful application of the modern instrument the size of the suction cup and the degree of vacuum should be individualized according to the hardness of the lens, the size of the pupil, and the resistance of the zonule. Obviously the same cup with a set vacuum is not suitable for all types of cataract. The harder the cataract the smaller should be the cup and the greater the suction. The soft intumescent lens requires a cup with a large surface and low degree of suction. In order to avoid dislocating the lens care should be taken that the cup is firmly applied to the lens surface before suction is initiated. Suction should be abandoned at the slightest appearance of vitreous. To loosen the attachment between the lens and the hyaloid the lens should be rotated about its horizontal meridian, as advocated by the Greens. The delivery of the lens should be assisted by Smith's maneuver with a forceps applied at the lower limbus, and advanced over the cornea, so that when the lens is completely delivered the corneal flap is in its place and the wound is closed.

Ray K. Daily.

Samuels, B. Cataract associated with intraocular tumors. *Arch. of Ophth.*, 1946, v. 35, April, pp. 366-383.

The condition of the lens is described in a study of 57 globes containing intra-ocular tumors, 34 malignant melanomas, 21 retinoblastomas and one each of epithelioma of the ciliary body and of sarcoma. Folds of the lens capsule were infrequent, possibly because most of the globes were glaucomatous. Proliferation of the lens capsule was not a characteristic but there were instances in which the restricted proliferation showed unusual features. Necrosis of the subcapsular epithelium was observed in malignant melanomas along with necrosis of the tumor. This change was a rarity in retinoblastoma. Direct contact of the tumor with the lens seldom interfered with the transparency of the lens nor was dislocation a feature. Cataractous changes were frequently noted in the anterior and posterior cortex whereas the equator was less often affected. Calcification of the lens substance was observed in three cases of retinoblastoma. Other less striking features are discussed as well as aspects of clinical diagnosis of tumors associated with cataracts. (16 illustrations.) John C. Long.

Sasiain, M. R. The metabolism of the lens. *Arch. de la Soc. Oft. Hisp-Amer.*, 1945, v. 5, April, pp. 273-287.

The author reviews the literature and gives the following summary: The metabolism of the lens takes place through an electrotonic interchange in an anoxibiosis. The catalytic enzymes and the systems of oxyreduction are indispensable for the metabolism of the lens. Transparency of the lens and accommodation the the two principal functions dependent on the lens metabolism. To maintain normal lenticular transparency and accommodation the reduction power of the lens has to

reach and maintain a certain level. If the metabolic harmony of the lenticular constituents is lost, they precipitate, causing opacification of the lens.

Ray K. Daily.

Sedan, J., and Sedan-Baubys, J. Preliminary micropuncture in certain cataracts. *Ann. d'Ocul.*, 1946, v. 179, no. 1, pp. 35-40.

In milky cataracts and in some other types in which the capsule cannot be easily grasped with capsule forceps, a peripheral iridectomy is performed. The upper periphery of the lens is punctured as near the equator as possible with a fine needle. A small amount of milky lens matter exudes which facilitates grasping of the capsule with smooth capsule forceps preparatory to removal of the lens in its capsule.

Charles A. Bahn.

10

RETINA AND VITREOUS

Amat, M. M., and Enciso, M. M. External exudative retinitis, or Coats' Disease. *Arch. de la Soc. Oft. Hisp-Amer.*, 1945, v. 5, Aug., pp. 623-630.

The authors describe the left eye of an 8-year-old girl, that had typical changes at the posterior pole as well as peripheral angiomas mostly in the inferior temporal portion of the retina. The general examination was negative, except for an eosinophilia of 6 percent. The literature on the pathogenesis of the affection is reviewed, and it is pointed out that neither Leber's theory of fibrinous exudation with subsequent degeneration of retinal tissue, caused by toxins that arise in small microbial emboli of low virulence, nor the modern conception of an endocrine disturbance that affects the permeability

of the capillary endothelium have any experimental support. (2 colored illustrations.) Ray K. Daily.

Azzolini, U., and Longo, P. Tortuosity of the retinal vessels considered as a part of a general vascular malformation (*Hamartosis vascularis diffusa*). *Riv. di Oftalm*, 1946, v. 1, p. 35-51.

The authors review numerous case reports from the literature and add one of their own to show that tortuosity of the retinal vessels may be considered as a part of a general vascular anomaly. The name *hamartosis vascularis diffusa* is proposed (from the Greek *hamartanein*, to miss). Albrecht coined the term *hamartoma* for a developmental anomaly of a tissue which still remains identifiable with its physiologic structure and does not assume autonomous and destructive growth; the authors extend the expression *hamartosis* to denominate a congenital anomaly affecting the whole vascular system. Their patient, a woman aged 42 years, had telangiectases in the palpebral conjunctivas, in the fingernail folds and in the bladder, and a very pronounced retinal vascular tortuosity. They believe that the syndromes of Hippel-Lindau, Osler-Rendu, Sturge-Weber, Coats, and Groenblad-Strandberg all are related phenomena, due to a congenital anomaly of the mesenchymal system, particularly of the encephalo-chorio-retinal vascular tissue. (8 figures, bibliography.)

K. W. Ascher.

Barraquer Moner, José-I. A speculum (*Ecarteur*) for operation of detached retina. *Ophthalmologica*, 1946, v. 111, Jan., pp. 61-64.

The author recommends three instruments to be used in the operation for detachment of the retina instead of the lid speculum: a forked double muscle hook that can be slipped under two adjacent rectus muscles; a simple hollowed hook which is needed in introducing the former and a spoon-shaped spatula that is introduced into the orbit and serves as a retractor.

The advantage of these instruments lies in the fact that the cornea is protected by the eyelids during the operation. (1 photograph, 3 drawings, bibliography.) F. Nelson.

Cutler, N. L. Transplantation of human vitreous. *Arch. of Ophth.*, 1946, v. 35, June, pp. 615-623.

A technique is described for the transplantation of human vitreous from one eye to another. From 1.5 to 2 cc. of vitreous is aspirated from the recipient eye through an equatorial scleral incision using an 18 gauge needle and 2 c.c. of vitreous from the donor eye is then injected through the same needle. Three eyes in which this procedure was utilized are reported in detail. All three had old vitreous hemorrhage. In two of them the operation was successful with a decided reduction in the opacity of the vitreous. In the third there was failure, probably because of an old retinal detachment and a recurrent vitreous hemorrhage. There was a moderate reaction after the procedure, but no evidence of a foreign protein reaction was noted. The tension of all three eyes returned to normal within a reasonable period and remained normal. The blood group does not appear to be significant. (References, 1 figure.)

John C. Long.

Elwyn, H. Heredodegenerative diseases of the retina. *Arch. of Ophth.*, 1946, v. 35, June, pp. 662-669.

Heredodegeneration is used to designate diseases of the central nervous system which in the main are characterized by a specific loss of neural tissue as a result of hereditary influences. These diseases may be classified according to the conditions under which they are found or according to the anatomic structure involved.

Diseases originating in Bruch's membrane include disciform degeneration of the macula and angioid streaks in the fundus. Hyaline bodies originate in the pigment epithelium. Among the numerous diseases of the neuroepithelium are macular degeneration of various types, retinitis pigmentosa, retinitis punctata albescens, congenital night blindness, color blindness, gyrate atrophy, and choroideremia. Disorders of the ganglion cells give rise to Tay-Sachs disease, juvenile type of amaurotic familial idiocy, and Niemann-Pick disease. Involvement of the nuclear layers produces peripheral cystoid degeneration and widespread cystoid degeneration, forming the basis for rupture of the retina with hole formation. Retinitis circinata also originates in the nuclear layers. Tuberous sclerosis is a widespread heredodegenerative disease causing the production of abnormal cells and tumors in the nerve fiber layer. (References.) John C. Long.

Feigenbaum, A., and Kornblüth, W. Intravitreal injection of penicillin in a case of incipient abscess of the vitreous following extracapsular cataract extraction. Perfect cure. *Ophthalmologica*, 1945, v. 110, Nov.-Dec., pp. 300-305.

A case of abscess formation in the vitreous following extracapsular cataract extraction and its complete cure by intravitreal injection of penicillin is described. The adjuvant value of subconjunctival injections in overcoming the infectious process is stressed. The probability of synergistic action from the simultaneous use of sulfadiazine is mentioned. (References.) F. Nelson.

Filatov, V., and Verbitska, V. Treatment of retinitis pigmentosa. *Am. Rev. Soviet Med.*, 1946, v. 3, June, pp. 388-394.

The injection of cod liver oil in retinitis pigmentosa produces a rapid improvement. In some instances effects are noted after one to two injections.

Increase in light sensitivity can be obtained by intramuscular injections of cod liver oil and by other methods in retinitis pigmentosa. The increase in light sensitivity after cod liver oil treatment is superior to other methods used. For example, when the Lauber method was used, the increase of light sensitivity was not more than 10 times in only one out of five cases. When retinol was used, there was an increase of 10 to 15 times only in five patients out of 12. Twelve cases of retinitis pigmentosa were treated by parenteral administration of cod liver oil, and in one patient there occurred an increase in light sensitivity of 1000 times, in another an increase of 50 times, and in five cases an increase of 10 times.

Effects produced by the use of cod liver oil were observed in very severe, chronic forms of the disease.

On the basis of these observations it can be said that the parenteral use of cod liver oil in the treatment of reti-

nititis pigmentosa is very effective and deserves further study.

The authors' cases of retinitis pigmentosa, treated with injections of cod liver oil, could not be followed for a long enough period. It is still too early to judge results. Further observations might indicate prolonged treatment or repeated injections at intervals.

Filatov thinks that cod liver oil acts not only through its vitamins, but also through other liver by-products. He worked with the transplantation of preserved tissues, such as skin and conjunctiva, and showed the effect of these products. In order to verify the mode of action of cod liver oil, a small piece of human liver preserved at a low temperature was implanted under the skin of a patient with retinitis pigmentosa.

Theodore M. Shapira.

Filatov, V. Retinitis pigmentosa. *Am. Rev. Soviet Med.*, 1946, v. 3, June, pp. 395-396.

Favorable results have been obtained in retinitis pigmentosa after implantation of preserved vascular membrane or placenta under the conjunctiva on the trephined sclera. Similar effects followed implantation of liver under the skin of the abdomen, transplantation of preserved skin to the head or the abdomen, and injection with cod liver oil.

Treatment by injection of cod liver oil was given to 60 patients; in 8 there was no effect; in 52, improvement was noted subjectively and during functional examination of the patient.

The patients showed heightened visual acuity, often to 0.2 to 0.3, and sometimes to 0.5 to 0.6. There was improvement also for close reading. The field of vision was widened 15 to

20 per cent, both peripherally and in the center, so that sometimes there remained only annular scotoma, which was sometimes incomplete. Moderate improvement in dark adaptation was also observed. Sometimes it was considerable and in individual cases complete restoration was noted.

Another important finding was decrease and even complete disappearance of photopsy which was apparently first established as a symptom of retinitis pigmentosa by Verbitska.

In the majority of the patients improvement of visual functions occurred after the first 4 to 10 injections of 0.5 c.c. each, and in some after 15 to 25 injections. Improvement of functions does not stop after discontinuing injections, and may persist for a few weeks. After several months the functions may regress, but can be restored by repeated courses of cod liver oil or additional tissue transplantations.

Implantation of placenta under the conjunctiva was made in 22 patients; implantation of placenta was also performed subcutaneously in six. In these 28 patients the results obtained were approximately the same as those with cod liver oil, namely a marked improvement in 22. Implantation of preserved liver under the skin gave a significant and prolonged effect in four out of five patients. Transplantation of skin produced an effect in 7 of 17.

It is apparent that the fight against retinitis pigmentosa, which seemed hopeless, is nevertheless possible; and modern ophthalmology need not confine itself to the recording of retinitis pigmentosa nor need it reconcile itself to the inevitable blindness.

Treatment by implantation of preserved tissues and by intramuscular injections of cod liver oil, singly or in

combination, is a most effective method for the treatment of retinitis pigmentosa. It does not lead to cure, but aids the handicapped by restoring work capacity. Theodore M. Shapira.

Filatov, V. P., and Verbitska, V. A. Implantation of preserved placenta in retinitis pigmentosa. *Am. Rev. Soviet Med.*, 1946, v. 3, June, pp. 397-398.

The favorable effect obtained in retinitis pigmentosa by parenteral administration of cod liver oil depends, according to Filatov, not only on the contained vitamins, but also on the disintegration products of the liver formed during its preparation. Improved retinal functions observed after implantation of preserved liver in retinitis pigmentosa confirm this supposition. However, Filatov held that the influence of preserved liver on the retina is not specific and that other preserved tissues also can produce such an effect.

Three cases of retinitis pigmentosa are presented here in which implantation of preserved placenta was made.

The case histories cited show that implantation of placenta in retinitis pigmentosa gives encouraging results. A prolonged period of observation is necessary for proper evaluation of this therapeutic measure.

Theodore M. Shapira.

Filatov, V. P., and Verbitska, V. A. Implantation of preserved liver. *Am. Rev. Soviet Med.*, 1946, v. 3, June, pp. 398-399.

Several cases of retinitis pigmentosa were treated by intramuscular injections of cod liver oil with good results. Filatov thinks that the active principle of cod liver oil is the byproduct of liver obtained during the extraction of oil.

The action of cod liver oil is analogous to the action of transplanted preserved tissue. To verify this supposition liver was implanted subcutaneously in cases of retinitis pigmentosa.

Two cases are presented in which such implantation was performed. In the cases cited implantation of liver caused definite improvement in retinal functions.

The cases presented are indirect confirmation of Filatov's proposal that the active principle of cod liver oil is the byproduct of liver disintegration.

Theodore M. Shapira.

Fritz, M. The effect of cranial trauma on the retinal circulation in war injuries. *Bull. Soc. Belge d'Ophth.*, 1945, no. 81, April 29, pp. 45-50.

The change in the retinal circulation following cranial traumatism in war injuries consists of an alteration in arterial tonus. The author points out that there is either a decrease in tonus, which is the usual case, or an increase in tonus, and occasionally it is possible to have a diminished and raised tonus simultaneously, affecting different arterial sectors in the same individual. The author also notes that a frequent change following cranial trauma is perivascular retinal edema, which is actually the factor responsible for the pathologic enlargement of the angioscotoma. He presents a case of a war wound in the parieto-occipital area, in which funduscopy revealed that the central retinal artery was abnormally constricted, although the nasal superior branch was dilated. M. R. Cholst.

Hazelton, A. R. The nature of starvation amblyopia. *J. Royal Army Med. Corps*, 1946, v. 86, April, pp. 171-178.

Of a group of 409 patients at an

Australian Army hospital, who complained of dimness of vision, 277 were classified as having "avitophthalmia," either active or inactive. The active group (156) presented symptoms which were classified in two groups: (a) eyestrain (exhaustion of ciliary muscle), and (b) retinal damage. In the former group, characterized by headache, pain in eyes, and heaviness of lids, marked improvement was obtained by administration of thiamine. The latter group was characterized by blurred daytime vision, photophobia, transient central scotoma, and changes in colors.

The author uses the Ladd-Franklin color theory to explain the reported color changes in terms of a deficiency of the photosensitive substance of the retinal cones. Administration of thiamine, nicotinic acid, and haliver oil had no effect upon these "retinal" symptoms.

Eight patients received, in addition to their regular diet, 10 raw eggs daily for 30 days. All eight were considered to have benefited from this dietary regime; one case was considered "cured."

Benjamin Milder.

Ibáñez Puiggari, M., and Malbrán, J. An apparatus for surgical treatment of retinal detachment. *Arch. Chilenos de Oft.*, 1945, v. 2, Nov.-Dec., pp. 7-13.

With detailed description and abundant illustration, the authors discuss an apparatus for use in connection with the detachment operation, including diathermy appliances, ophthalmoscope to be used during the operation, and other particulars. The whole apparatus is stored in a large metal chamber, capable of being hermetically sealed, using formalin tablets for sterilization, and attached to the wall by a bracket

permitting adjustment in the vicinity of the operating table. Detailed study of the original descriptions and illustrations is essential for understanding of the device. (6 photographs, full-page clinical drawing, references.)

W. H. Crisp.

Joly, J. P. A case of exudative retinitis (Coats). *Arch. d'Ophth.*, 1946, v. 6, no. 1, pp. 46-48.

A case of unilateral exudative retinitis, considered to be Coats' disease, was observed in a young man of 19 years. The fundus lesion, which was in the upper temporal region, was complicated several weeks after onset by a cyclitis. Focal infection studies were negative. There was no family history of tuberculosis. Nonspecific therapy resulted in some improvement.

Phillips Thygeson.

Longhena, Luisa. Two cases of Intraocular cysticercus. *Riv. di Oftalm.*, 1946, v. 1, Feb., pp. 94-109.

One patient with a subretinal cysticercus cellulosa refused to undergo the proposed operation; in the other, the parasite was found in the vitreous and the eye enucleated. The pathologic findings are described. (8 illustrations, bibliography.)

K. W. Ascher.

Maeder, G. Hereditary hemeralopia and syndactyly. *Ophthalmologica*, 1946, v. 111, April-May, pp. 278-284.

Congenital severe hemeralopia and syndactylism of the toes were found in four generations of a family. The pedigree is outlined. Only one family member apparently was affected with both anomalies. The possibility of a lesion in the diencephalon and a relationship to the Lawrence-Moon-Biedl-

Bardet syndrome is mentioned. (3 figures, references.)

Alice R. Deutsch.

Maggiore, L. On the functional relations between the pigmented epithelium and the neuro-epithelial layer of the retina. *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 73, Jan., pp. 3-16.

On the basis of studies and observations made by himself and others the author formulates three hypotheses to explain the partial persistence of visual function in the affected part of the retina in shallow detachments and in incomplete re-attachments of the retina.

1. The partial persistence of visual function may be due to the fact that the pigment-bearing processes of the pigmented epithelium—in the form of finely drawn-out filaments—may bridge the space between the pigmented epithelium and the neuro-epithelium. Only when the space between these layers exceeds a certain limit, so that it is no longer bridged in this fashion, does the affected part of the retina become absolutely blind. The progressive reduction in vision can thus stand in direct relation to the progressive decrease in these residual connections between the two layers.

2. It may also depend on the amount of fluid separating the two layers. If the amount is small, the concentration of substances originating in the pigmented epithelium may be sufficient to act upon the neuro-epithelium and thus assure a certain measure of visual function, whereas, if the amount of fluid exceeds a certain limit, the dilution, of the substances diffused from the pigmented epithelium may be so great that the neuro-epithelium is not affected by them. The subretinal fluid, either by its mere presence or by its chemical

constitution, may also affect the normal metabolism of the retina.

3. According to Schanz's theory, electrons liberated from the pigment cells by the action of light or originating in reactions between substances produced by the pigment cells and other substances contained in the rods and cones, play an essential part in vision. The partial persistence of visual function may be explained by the supposition that these electrons can act upon the rods and cones only when the thickness of the subretinal fluid does not exceed a certain limit.

None of these three hypotheses can be considered sufficient in itself to furnish an adequate explanation, but they are all in accord with the clinical observation that the visual function of the retina is retained to a certain extent in shallow detachments but is completely annulled in bullous detachments.

Harry K. Messenger.

Miranda, A. G. Acute hypotony in retinal detachment. *Arch. de la Soc. Offt. Hisp.-Amer.*, 1945, v. 5, Aug., pp. 664-672.

The literature is reviewed, and a case of this rare occurrence reported. The 56-year-old woman, with myopia of 20 diopters and a history of a loss of vision in the nasal part of the field of the left eye of two weeks duration, presented herself with violent pain and intense congestion in the eye. She had conjunctival chemosis, corneal cloudiness, turbid aqueous, a deep anterior chamber, an almost complete retinal detachment, and a detachment of the inferior nasal portion of the choroid. The tension was negative, and the eyeball was extremely sensitive to touch. Under atropine the acute symptoms subsided in six days, and the

choroidal detachment disappeared. The pathogenesis of the phenomenon is discussed, and it is pointed out that the presence of the ciliary injection, the turbid aqueous, and the pain indicate the presence of a cyclitic process. Possibly the products of disintegration of some of the constituents of the sub-retinal fluid were the cause. The detachment of the vitreous so frequent in retinal detachment, through retraction of the iris and lens may have produced the deep anterior chamber. Functional circulatory disturbances, and scleral dehiscences with escape of the intraocular fluid are also factors to be considered in the genesis of acute hypotension in some cases. Since the use of a compressive bandage in the treatment of retinal detachment has been abandoned, cases of acute hypotension are encountered rarely. (Visual field.)

Ray K. Daily.

Monnier, M., and Amsler, M. **Objective examination of the function of the retina with the electroretinogram in a case of concentric contraction of the visual field.** *Ophthalmologica*, 1945, v. 110, Nov.-Dec., pp. 225-241.

After an accident without direct injury to the skull a patient had various subjective and objective encephalopathic symptoms. Among them were mouches volantes, fatigability during reading, insufficiency of convergence, "accommodtonie", diminution of the central visual acuity, and concentric narrowing of the visual field, with occasional variations from day to day but never larger than 60° on the temporal side and 35° on the nasal.

Electroretinograms showed that the retina had a normal, if not increased receptivity, even in the peripheral, apparently blind parts of the fields.

Furthermore, the considerable amplitude of the positive potentials, particularly of the b₊ potential, seemed to indicate that the retinal excitations were normally discharged in the optic nerve.

On the basis of these electroretinographic data, one would have expected the patient to be dazzled and to present exaggerated blinking reflexes but he behaved as though the retinal excitations, normally discharged in the optic nerve, did not reach the visual centers and the motor centers of the blinking reflexes. Since the first optic neurones functioned normally, as proved by the electroretinogram, it must be assumed that the optic excitations were stopped either at the level of the mesodiencephalic synapses (superior, colliculus lateral geniculate bodies), or at the level of the optic neurones in the occipital center. The evidence and localization of such synaptic stoppage are discussed in the light of experimental and clinical data. The physiopathology of the concentric narrowing of the visual field and the partial loss of the blinking reflex are also discussed. (References, photograph, 1 table, diagrams, visual fields.)

F. Nelson.

O'Malley, C. L. **Retinal hemorrhage with vitreous clouding in young adults (Eales' disease).** *Trans. Ophth. Soc. U. Kingdom*, 1944 v. 64 pp. 261-269.

The author describes four patients with recent vitreous hemorrhages. The oldest patient was a woman 36 years of age and the other three were young men 22, 29, and 30 years of age.

He divides the disease into four distinct stages. In the first stage small round hemorrhages are seen scattered in the periphery and related to the small end twigs of the venous branches

and there is low intraocular tension. In the second stage there is leakage of blood and plasma from the larger venous branches into the pre-retinal plane with associated vitreous clouding. Vision is not affected. In the third stage main trunks are involved. Blood and exudate leaks along vessels and into the vitreous which becomes densely clouded. Vision is reduced and ocular tension increased. In the fourth stage the fundus shows the scars of many attacks with permanent vitreous clouding and vascularized fibrous tissue bands. Ocular tension is increased. Eales' disease has many characteristics of an allergic response. The specific lesion is a peripheral endophlebitis associated with a sex-linked hormone.

Beulah Cushman.

Redslob, E., and Bronner, A. Retinal hemorrhages in senile purpura and glaucoma without hypertension. *Ann. d'Ocul.*, 1946, v. 179, no. 2, pp. 64-70.

This unusual combination of degenerations was observed in a woman 74 years of age. Intraocular hemorrhages with absorption followed cataract extraction in both eyes. Concurrent hemorrhages appeared in the skin, especially near the elbow. Upon excision the skin showed absorption of the elastic tissue which resulted in enlargement of the capillaries and subsequent hemorrhage. Blood tests and other examinations were essentially negative.

The author reasons that intraocular hemorrhage and glaucomatous excavation with hypotension were due essentially to constitutional presenile degeneration which involved the absorption of the elastic tissues in and about the vessels and in the papilla. Secondary capillary dilatation with oc-

casional transient hypertension presumably caused the hemorrhages.

Charles A. Bahn.

Regoli, Attilio. Angioid streaks of Knapp with cardiovascular changes. *Boll. d'Ocul.*, 1944, v. 23, Oct.-Dec., pp. 209-228.

A man, 35 years of age, and recently affected by marked diminution of vision in both eyes, showed the classic picture of angioid streaks of the retina with a diffuse chorioretinitis of the macular and perimacular regions in both eyes. The general examination revealed changes in the cardiovascular system as evidenced by a mitral murmur and slight hypertension. The cardiovascular changes have great importance from a diagnostic point for these general changes are associated with changes of the elastic tissue. The retinal streaks are not to be considered a distinctive entity but as part of a complex syndrome that results from a dystrophy of the elastic tissue of degenerative origin. In this patient there was no elastic pseudoxanthoma of the skin, therefore this disease represents an incomplete syndrome of systematized elastorexis. (Bibliography.)

Melchior Lombardo.

Rønne, Gerhard. Local treatment of intrabulbar infections. General Considerations. *Acta Ophth.*, 1944, v. 22, pt. 1, pp. 95-104.

Rønne discusses the general criteria for experimental investigation on the efficacy of intrabulbar injections. The isolation of the ocular contents by a thick capsule, the transparency of the media that permit observation of the intraocular process, and the non-cellular structure of the vitreous make the eye a sensitive and easily accessible

biological medium. The literature on experimental intrabulbar therapy is briefly reviewed, and the reasons for the lack of development of clinical intrabulbar therapy is discussed.

Ray K. Daily.

Santoni, A. Investigations concerning the index of refraction and the pH of the subretinal fluids in idiopathic retinal detachment. *Riv. di Oftalm.*, 1946, v. 1, Jan., pp. 3-14.

Subretinal fluids obtained during 33 detachment operations from 30 eyes were examined with the refractometer of Pulfrich and with the quinhydrone-electrode, if sufficiently large amounts were withdrawn. Fluids containing traces of blood were discarded. The index of refraction of fluids from eyes with a history of eight days to 25 months of retinal detachment, varied between 1,334 and 1,340; no definite relationship was found between duration of the detachment and refractive index. There was no correlation between the refractive index and the operative result. Santoni stresses the possibility of errors due to previous small hemorrhages into the subretinal fluid. The H-ion concentration varied from pH 7.45 to pH 8.00. Whereas the fluids having a pH of 7.67 to 8.00 were withdrawn from detachments of long duration, more recent detachments revealed readings as high as 7.73 and 7.8. He compares his results with those obtained by Weve and Fischer, and those of Contino, and discusses the retinal metabolism in normal and in diseased eyes. The shift to the alkaline side may be due to the production of ammonium and of other amines as suggested previously by Weve and Fischer.

K. W. Ascher.

Satanowsky, Paulina. Two cases of embolism of a branch of the central retinal artery with recovery. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Nov., p. 579.

Two cases of sudden and complete obstruction of a branch of the central retinal artery in elderly individuals with hypertension are reported. After treatment with acetylcholine and nicotinic acid the symptoms gradually disappeared and the ophthalmoscopic picture improved. The differential diagnosis of spasm and embolism is discussed with special emphasis on the perimetric findings. (Visual field charts, bibliography.) Plinio Montalván.

Schantz, E. M., Embree, N. D., Hodge, H. C., and Wills, J. H. Jr. The replacement of vitamin A₁ by vitamin A₂ in the retina of the rat. *J. Biol. Chem.*, 1946, v. 163, May, pp. 455-464.

The experiment reported in this paper was performed to determine the extent to which animals using vitamin A₁ (ordinarily referred to as "vitamin A") in their bodily functions could replace the A₁ with vitamin A₂. The livers of fresh-water fish have been found to contain vitamin A₂, a substance closely related to vitamin A₁, which is found in man and most other animals. These same fresh-water fish have a photosensitive retinal pigment different from the rhodopsin, or "visual purple," of human retinas. This pigment, called "porphyropsin," has an absorption spectrum which is distinct from that of rhodopsin.

In this experiment, albino rats were depleted of their normal vitamin A₁ stores, and then were fed diets containing only vitamin A₂ for twelve weeks. It was found that the visual

purple, or rhodopsin, normally found in the rats, had been replaced by porphyropsin (measured spectrophotometrically). Further, bleaching of the retinas of these rats produced no retinene, a substance normally found after the bleaching of rhodopsin.

Vitamin A₂ was stored in the livers of these experimental rats, just as vitamin A₁ is normally stored. In the blood, however, the vitamin A₂ level was built up very slowly, while the vitamin A₁ levels diminished little.

The authors concluded that vitamin A₂ could replace A₁ satisfactorily in many bodily functions.

Benjamin Milder.

Schmid, A. E. Relations of periphlebitis of the retina and recurrent juvenile hemorrhages into the vitreous to endangiitis obliterans. *Ophthalmologica*, 1945, v. 110, Nov.-Dec., pp. 259-291.

The author outlines the history of the subject and reviews the literature. He analyzes the examinations of the eyes of 86 patients with endangiitis obliterans of 25 patients with periphlebitis of the retina and juvenile recurrent hemorrhage of the vitreous.

Marchesani's contention that periphlebitis of the retina and juvenile hemorrhage of the vitreous are manifestations of endangiitis obliterans cannot be proved. Periphlebitis of the retina, juvenile recurrent hemorrhages of the vitreous, and the accompanying iridocyclitis are, if not exclusively, in the majority of cases due to tuberculosis. (2 tables, 3 curves, 2 Rontgenograms.)

F. Nelson.

Stenström, Solve. Retinitis centralis serosa. *Acta Ophth.*, 1943, v. 21, pt. 1-2, pp. 97-106.

This disturbance which frequently

occurs in Japan, is characterized by a circumscribed macular edema. It is thought to be rare in Europe, but the fact that five cases were seen at the Sahlgren eye clinic in one-half year suggests that perhaps these cases are not as rare as is believed, and that many are being overlooked. Stenstrom's five cases had no definite etiology, and he suggests that this may be a symptom complex of varied etiology and not a disease entity. That it may occur on a vascular basis is shown by one of his cases in which the macular lesion appeared in a hypertensive fundus. After a time the picture changed to that of a hypertensive retinitis.

Ray K. Daily.

Traquair, H. M. The nerve fibre bundle defect. *Trans. Ophth. Soc. United Kingdom*, 1944, v. 64, p. 3.

The author describes in detail the anatomy and vascular supply of the retina in order to clarify some of the questions which arise in the analysis of visual fields.

The fibres from the nasal half of the retina converge directly from the periphery to the papilla in a straight course. The temporal fibres lie in arches above and below the macular area. The arches extend from the raphé, which lies on the horizontal meridian between macula and periphery, to the papilla. On the papilla the fibres are gathered together to form a thick cushion, except in the temporal quadrant where the nerve fibre layer appears thinner and less vascular.

The term *nerve fibre bundle* refers to any small group of fibres which lie together as they enter the papilla although there is no anatomical segregation into such groups in the retina. Lesions of such a group near the

papilla cause a scotoma that corresponds to the area of fibres involved, and is wedge-shaped or cuneate, narrow near the blind spot and wider peripherally. Arcuate bundles consist of uncrossed and crossed fibres, and straight bundles are made up of crossed fibres only. The nerve fibre raphé ceases at the temporal edge of the fovea.

Retinal arteries have an arrangement similar to that of nerve fibres. The vascular twigs overlap the temporal half of the horizontal meridian above and below and follow a wavy line. Vessels often pass through the macula towards the papilla and may divide the macula horizontally. On the nasal side the arteries extend in a radial direction. The papillo-macular area may be wholly or partly supplied by a cilio-retinal artery. The optic nerve is nourished by small branches of the ophthalmic artery. The chiasma receives twigs from the adjacent vessels.

The nerve fibre bundle defect is recognized by its shape and is the result of any localized lesion which impairs the conducting power of a group of adjacent fibres. The most common are the lesions produced by glaucoma and the inflammatory focus of deep choroiditis. Other causes are vascular obstruction, foreign bodies in the retina, and retinal hemorrhages. The causal lesion may be situated in the visual pathway behind the eyeball as far back as the chiasm. When the field defect does not extend to the periphery it may be assumed that the whole thickness of the nerve fibre bundle is not affected.

Vascular obstruction may affect the functional efficiency in the retinal area of the distribution of the affected vessel because both ganglion cells and

nerve fibres are deprived of blood, and also because the nerve fibres at some distant point may be subjected to ischaemia and rendered non-conducting. The blind spot is usually separated from the scotoma by an area or bridge because of the double vascular supply of the retina adjoining the papilla.

Nerve fibre bundle defects with scotoma occur in every case of chronic simple glaucoma. The belief that enlargement of the blind spot is an early sign of glaucoma is based on inadequate observation. The scotomas may begin anywhere in the line of the arcuate fibres except at the edge of the blind spot; 60 percent arise in the upper part of the field and less than 40 percent in the lower. Straight cuneate defects on the temporal side of the blind spot are rare in the early stages. The temporal side of the blind spot appears to be lost by peripheral depression in quite a different manner from that on the nasal side.

The author does not feel that the piling up of the nerve fibres on the nasal side of the disc explains the characteristic scotoma as the upper part of the field may be completely destroyed while the lower is intact or vice versa. On the nasal side the nerve fibre layer is thick and has few blood vessels; on the temporal side the fibre layer is thin and the blood vessels very minute and it is here that the lesions are more frequently found. The invulnerability of the macular fibres is unexplained. Why the defect practically never begins at the equator of the disc on either side and why the field is lost on the temporal side in a manner quite different from that on the nasal side is not clear.

The slenderness of the nerve fibre bundle defect indicates a correspondingly narrow lesion. The growth of the

scotoma towards the blind spot would seem to indicate that it is the position of the affected nerve fibres in the retina that explains the phenomenon.

The fibre bundle defects of glaucoma remain an ophthalmologic puzzle; a study of the finer anatomy of the vascular supply to the fibres may be helpful.

The characteristic central scotoma of retrobulbar neuritis has been attributed to a special vulnerability of the macular fibres but the author feels that the fibres affected are probably selected on an anatomic basis.

Injury to the optic nerve due to a blow on the temple produces the bundle defect more often than retrobulbar neuritis and the damage is probably due to trauma to the small arterial twigs.

In bitemporal hemianopsia the bundle defect can be traced and the most plausible explanation of its characteristics is found in the arrangement of the nutritive vessels.

Definite nerve fibre bundle defects have not been found in lesions above the level of the chiasm.

Nerve fibre bundle defects are never found in toxic amblyopia or the amblyopia of squint. They are common in affections of the visual pathway between the retina and chiasm.

Beulah Cushman.

Vázquez Barriere, A., and Boado, L. A. Congenital folds of the retina. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Nov., p. 572.

Two cases of congenital folds of the retina are reported. In the first the fold, which coexisted with a persistent hyaloid artery, was related to the position of the fetal cleft; in the second there were no vestiges of the hyaloid

artery and the position corresponded to an inferior temporal sector between the three and five o'clock meridians. The literature is briefly reviewed. (Illustrations.) Plinio Montalván.

Weekers, Roger. Seasonal variations of the frequency of occurrence of idiopathic retinal detachment. *Ophthalmologica*, 1945, v. 110, Sept.-Oct., pp. 218-223.

Of 208 cases of idiopathic detachment of the retina 31 percent occurred in summer, 30 percent in spring, 20 percent in autumn and 18 percent in winter. Detachments caused by retinal or choroidal neoplasms or an inflammatory uveal process were eliminated from the statistical material.

Continued intensive solar radiation may be a factor in the development of detachment of the retina. There is reason therefore, to advise patients who are predisposed to this affection to avoid bright light and to wear dark glasses on sunny days.

F. Nelson.

Weekers, Roger. The cholinesterase of the retina. *Acta Ophth.*, 1945, v. 23, pt. 2, pp. 161-170.

In this laboratory study extract of bovine retinas was used for the investigation of its cholinesterase content. The data show that it is present in the retina and optic nerve, and is one hundred times more concentrated in the retina than in the nerve. It is evenly distributed throughout the whole retina, equal weights of peripheral and central parts of the retina contain equal amounts of cholinesterase. Its action is inhibited by the injection of eserine into the vitreous. Retinal cholinesterase is stable and maintains its activity after

24 hours in the refrigerator. (Graphs.)
Ray K. Daily.

Wille, Herluf. Investigations on the influence of K avitaminosis on the occurrence of retinal hemorrhages in the newborn. *Acta Ophth.*, 1944, v. 22, pt. 3, pp. 261-269.

In a control material of 594 cases, retinal hemorrhages which left no trace after their absorption were found in 42.4 percent. The administration of vitamin K intramuscularly to 316 patients before the onset of labor reduced the incidence of hemorrhages in the infants to 31 percent. Administration of vitamin K after the onset of labor was ineffective. The literature is reviewed and the relation of retinal to cerebral hemorrhage in the new born is pointed out. (Illustration.) Ray K. Daily.

Zentmayer, W. Angioid streaks of the fundus oculi observed over a period of thirty-six years. *Arch. of Ophth.*, 1946, v. 35, May, pp. 541-545.

A brief abstract of the clinical history of a typical case of angioid streaks of the fundus oculi observed over a period of thirty-six years is reported. The case was presented before the American Ophthalmological Society in 1909.

A review of the literature on the pathology is given and the author concludes from present evidence that angioid streaks are probably due to degeneration of Bruch's membrane, in which ruptures occur. The hemorrhages that are seen at various stages of the disease result from similar lesions in the walls of the blood vessels and the destructive changes that occur in the macula later are part of the syndrome. The gray zone about the papilla may be a manifestation of the

changes in Bruch's membrane; it is the only layer of the retina or the choroid which reaches the optic nerve, and it is much thicker in this area than elsewhere. R. W. Danielson.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Andersen, Borge. Some remarks on the inheritance of Leber's Disease. *Acta Ophth.*, 1944, v. 22, pt. 3, pp. 233-236.

The author evaluates the statistical data that support Lundsgaard's conclusions in her argument with Rønne. Ray K. Daily.

Broendstrup, Poul. Primary tumors in the optic nerve. *Acta Ophth.*, 1944, v. 22, pt. 1, pp. 72-94.

The literature is reviewed, and five cases are reported. Two of the tumors were oligodendrocytomas, and three were meningiomas. Characteristic of oligodendrocytomas is the occurrence of several types of glia cells in the same tumor. The structure of meningiomas is homogeneous. The prognosis, aside from loss of the eye, is good. The tumors do not metastasize, and have no tendency to recur. Therapy consists of removal of the tumor. (4 illustrations.) Ray K. Daily.

Bruetsch, W. L. Malaria therapy in syphilitic primary optic atrophy. *Jour. Am. Med. Ass.*, 1946, v. 130, Jan. 5, pp. 14-18.

Malaria therapy is conceded to be the most efficacious method of treatment of primary syphilitic optic atrophy. Routine treatment with arsphenamine, bismuth, and mercury is of no value. The best explanation is that malaria causes an arrest of the inflammatory phase of the neurosyphilitic process that goes

on within the optic nerves. Exactly how this occurs is unknown.

In favorable cases, one course only is needed. Tertian malaria is used. In patients who need another course, it is necessary to use the quartan type. Perhaps the addition of penicillin will prove of more value than therapy with malaria alone.

In patients who react favorably, there will be an expansion of the visual fields; in the others optic atrophy continues.

The relative uselessness of surgery is explained. (3 photographs, references.)

Bennett W. Muir.

Charlin, Carlos (C). Alcoholic optic neuritis. *Arch. Chilenos de Oft.*, 1945, 1st yr., May-June, July-Aug., nos. 6 and 7. p. 3.

A general discussion of the subject, as a clinical "lesson" under the two headings of "confessed alcoholism" and "concealed alcoholism," and on the basis of two clinical records of chronic alcoholism, with neuritis and atrophy.

W. H. Crisp.

Esbjerg, H. O. Central complications (papilledema) in epidemic parotitis. *Acta Ophth.*, 1943, v. 21, pts. 1-2, pp. 119-125.

This is a report of two unusual cases of papilledema due to a basal arachnoiditis with obstruction of the basal foramina that was a complication of mumps. The symptoms were so severe that the patients were operated upon with the erroneous diagnosis of a tumor in the roof of the fourth ventricle.

Ray K. Daily.

Faranier, G. Severe optic neuritis from methyl alcohol intoxication. *Ann. d'Ocul.*, v. 178, 1945, Dec., pp. 528-530.

A man, 44 years of age, developed

permanent blindness, weakness, abdominal pain, and delusions after 15 drinks daily of 40 percent methyl alcohol for 16 days. During the first week the pupils were dilated and fixed, the fundus normal. Then a slight papilledema and permanent pallor of the disc became manifest. Charles A. Bahn.

Hultquist, G. T. About aberrant fibers of the fasciculus opticus. *Ophthalmologica*, 1945, v. 110, July-Aug., pp. 1-14.

The author contributes two cases of aberrant fibers of the optic fascicle. In one of them a nerve-fiber bundle left the main fascicle by way of two roots, one of them behind the entrance of the central artery of the retina and the other in the temporal inferior part of the fascia of the eye muscles. After a separate course the aberrant bundle again entered the optic fascicle in the chiasm. Fibers of pure glial tissue radiated from the aberrant bundle as well as from the main stem of the optic fascicle of both sides and ended blindly in the connective tissue of the dura. These fibers are fundamentally interesting, inasmuch as they show that optic fibers that end blindly do exist and that these fibers are not medullated. A second case is described in which a cone of medullated nerve fibers protruded from the ventral side of the chiasm, similar to one reported by Volland. The literature and classification of aberrant optic nerve fibers is discussed, A new classification, based chiefly on the presence or absence of myelin sheaths in the aberrant fibers, is suggested. Max Hirschfelder.

Lundsgaard, Ruth. The inheritance of Leber's disease. *Acta Ophth.*, 1944, v. 22, pt. 3, pp. 227-232.

Lundsgaard criticizes Rønne's statistical procedure and believes that his conclusion as to inheritance of Leber's disease is erroneous. Rønne believes to have proved that the inheritance is cytoplasmic, while Lundsgaard believes that the germ for the disease is autosomal, almost completely dominant in the male, incompletely dominant in the female, and with a lethal action on the spermatozoa. Ray K. Daily.

Magitot, A. The optic nerve and the message it carries. *Ann. d'Ocul.*, 1946, v. 179, no. 1, pp. 24-34.

The optic nerve is not a nerve but essentially a commissure which unites two cerebral areas. It contains visual and photomotor centripetal fibers, and also centrifugal fibers whose functions are not yet known. Its 500,000 to 800,000 fibers carry more impulses than the posterior sensory portion of the medulla because the optic nerve acts as a visual receptor for an estimated 130,000,000 rods and 7,000,000 cones. The smaller and more numerous visual fibers are about 2μ in diameter. Since the cells of Schwann are missing, repair and replacement of the optic nerve are impossible. The nerve partly functions before birth, pupillary reactions having been observed in six months premature infants.

The optic nerve is not sensitive to pain, nor to physical or electric excitation. Phosphenes and pain resulting from optic nerve section, are due to traction on the retina and to pressure on the ciliary nerves. These phosphenes do not occur in sections of the intracranial portions of the nerve. The nerve carries principally centripetal impulses which travel at the rate of 300 feet per second, and which are generated by the ganglion cells in the retina. Basic

qualities common to all nervous tissues such as the summation and the all or nothing reactions, are also present in the optic nerve. The retina is ten times more sensitive than any photographic emulsion known. Two types of chronaxie are known to exist; (a) those of the photo-motor fibers are four times more rapid than the visual fibers, (b) those of the macular region are more rapid than those of the periphery. Both have been measured by phosphenes produced by electric excitations of known intensities. If the visual cells are solely involved all chronaxies are normal. If the bipolar cells are solely involved, direct excitation will produce abnormal chronaxies. If the ganglionic neurons are involved, only papillary excitation will produce abnormal chronaxies.

All nerve cells are sources of electricity producing two intensities of current; one in the dark and the other in the light. As these waves are similar in form, amplitude, and speed, strong excitations produce a larger number of waves. The latent period of optic nerve waves is 0.1 second. The onset of each wave is brisk and the succession of waves which follow are variable in duration. Different fibers carry different types of messages. Cones are essentially adapted for day vision and color vision; rods for night vision. Recently photochemical substances have been isolated from the cones, each with a different curve of absorption. One substance is sensitive to red, another to yellow, and a third to blue. These substances are not as strong as the visual purple of the rods, but are more rapidly reproduced and are reversible. Thus there are three types of cone fibers; one carrying red impressions, another yellow-green; a third blue.

These are combined in the brain to give the sensation of the color. The visual cortex acts as a huge central telephone exchange which receives and translates these messages. The exact relation of the pupillomotor fibers to the visual fibers is not known. Destruction of the geniculate body and the geniculate route does not modify pupillary mobility, which suggests a possible bifurcation of some fibers before they enter these parts. Anatomically and physiologically this does not seem probable because blindness may occur from optic atrophy with conservation of the photomotor reflex. Pupillomotor fibers apparently do not cross at the chiasm as do the visual fibers because antero-posterior section of the chiasm does not modify the pupillary reactions, direct or consensual. Stimulation of the chiasm and the optic tract however do produce a pupillary contraction. The pupillary fibers apparently occupy the internal border of the optic tract. Pupillomotor fibers carry messages involving pupillary contraction and dilatation, which is important in understanding the Argyll Robertson sign and the Adie syndrome.

The integrity of all nerve fibers depends upon the body of the neuron. The optic nerve has an axone in the ganglion cells.

Intoxications primarily attack different neurons and different fibers. Tobacco poisoning, for example, is accompanied by scotomas which become paracentral on the temporal side and may extend to the blind spot. Since all chronaxies are normal, the process is essentially a destruction of the red-green photochemical substances which eventually affects their cones. These toxic substances are transmitted to the retina from the choriocapillaris. Sec-

ondary temporal disc pallor is therefore due primarily to death of specific cones. In intoxication with barbiturates, alcohol, and lead, the ganglion cells are primarily affected. A secondary optic atrophy follows. Profound ischemia of cells involved in vision, if it lasts fifteen to forty-five minutes, usually results in rapid and often permanent loss of sight because the cells involved never return to normal.

Both centripetal and centrifugal degenerations occur in the optic nerve. After severe injuries slightly anterior to the chiasm several weeks elapse before the papilla becomes pale. The optic nerve is most vulnerable in the optic foramen. Charles A. Bahn.

Mollenbach, C. J. Delayed recovery in retrobulbar neuritis. *Acta Ophth.*, 1943, v. 21, pts. 1-2, pp. 126-132.

Three cases are reported. A woman 53 years of age had a small central scotoma and 6/60 visual acuity, with temporal pallor of the optic disks. Improvement set in 1½ years after the onset of the symptoms, and after 2½ years recovery was complete with vision 6/6 and 6/9 in the right and left eye, respectively. A man 54 years of age began to improve slowly 11 months after the onset of the illness. At the end of two years his vision improved from 6/60 to 6/12, and the relative central scotomata were much smaller in size. The third patient, a man, 31 years of age, had Leber's optic atrophy and after an improvement in visual acuity which began one year from the onset of the disease and lasted six months, visual acuity was again badly impaired, and the scotomata increased in size. (3 visual fields).

Ray K. Daily.

Offret, G. Concentric bodies in the sheath of the optic nerve, their significance and clinical interest. *Arch. d'Ophth.*, 1946, v. 6, no. 1, pp. 29-42.

Offret notes that concentric bodies (*corpora arenacea*) are seen in eyes from patients with various eye diseases, often without optic nerve involvement. The bodies are always found in connection with the arachnoid, generally in the subdural space. Since they are not seen apart from arachnoid cells, the author concludes that they must be formed by this membrane. He examined a large number of optic nerves from embryos, fetuses, infants, adults, and aged persons in longitudinal and transverse sections and found the bodies only in adult and aged eyes. He describes in some detail the morphology and constitution of the bodies and stresses the role of cell nests in their formation. The various stages in the formation of the bodies are described and the tinctorial properties noted. The author found the distribution of the bodies to be of interest. The majority were in contact with the dura, which they penetrated more or less deeply, and there was a concentration in the zone of the central vessels. He notes the similarity of the bodies to those encountered in the normal cerebral meninges and in meningoblastomas. The article is illustrated with twelve drawings. Phillips Thygeson.

Perera, C. A., and Stout, A. P. Intra-orbital melanosis and intracranial neuroepithelioma of the optic nerve. *Arch. of Ophth.*, 1946, v. 35, June, pp. 678-687.

A two-year-old Armenian girl was observed with glaucoma of the right eye. An iris inclusion operation was done which was followed by recurrent hemorrhages and finally, enucleation.

During the enucleation a ring of pigmented tissue was noted around the optic nerve extending about one inch into the orbit. This tissue was dissected out. Pathologic studies of the eye showed, in addition to the glaucomatous changes, complete detachment of the retina and a dense connective-tissue membrane behind the lens. In the optic nerve behind the globe was seen an unusual pigmented lesion, associated with rounded, hyaline masses and small psammoma bodies. A diagnosis of melanosis of the optic nerve was made. Later the child developed signs of a brain tumor and died. A neuroepithelioma of the right optic nerve, the optic chiasm, and the base of the brain was found. Complete pathologic studies of the involved tissues are reported. The literature dealing with melanotic lesions of the leptomeninges is discussed. (Eight photographs.)

John C. Long.

Rintelen, F. Arteriosclerotic optic atrophy. *Ophthalmologica*, 1946; v. 111, April-May, pp. 285-290.

The author's investigation consisted of the examination of 35 optic nerves from persons between 44 and 48 years of age. They were compared with eight nerves of younger persons with healthy vessels. The pathologic examination showed patches of degenerated nerve fibers with overgrowth or glial tissues and cyst formation caused by partial vascular occlusion, mostly close to the optic disc. The disease is not rare and may be the most frequent type of optic atrophy.

The diagnosis rests chiefly on the exclusion of other causes for the atrophy.

The author distinguishes three forms of arteriosclerotic optic atrophy. The

benign form characteristically affects old persons and manifests itself in the periphery of the nerve as senile capillary necrosis. A malignant form occurs in young people as well and progresses rapidly. Softened plaques appear in the optic nerve especially in the vascular part. Clinically this form may suggest glaucoma without hypertension. A third form results from direct pressure of the sclerotic carotid artery on the optic nerve and is clinically rare.

Alice R. Deutsch.

Rønne, Henning. The inheritance of Leber's disease. *Acta. Ophth.*, 1944, v. 22, pt. 2, pp. 203-213.

The author disagrees with Ruth Lundsgaard's conclusions (Leber's disease, Copenhagen 1944, Gyldendalske Boghandel) as to the type of inheritance of this disease. By an analysis of 12 of Lundsgaard's pedigrees and of 7 referred to by her in the literature Rønne believes to have demonstrated that the inheritance of Leber's disease is cytoplasmic and not autosomal.

Ray K. Daily.

Rucker, C. W. Bitemporal defects in the visual fields resulting from developmental anomalies of the optic disks. *Arch. of Ophth.*, 1946, v. 35, May, pp. 546-554.

One of the most dependable axioms in ophthalmology is that bitemporal hemianopsia indicates a lesion at the optic chiasm. Six cases reported here demonstrate that even to this rule there may be exceptions which can occasionally cause difficulty in diagnosis.

The types of field defects illustrated in these cases have been recognized for many years and are briefly described in two of the current standard textbooks on perimetry.

When it is suspected that a bitem-

poral hemianopic depression is due to anomalous disks rather than to a chiasmal lesion, the way in which the defect behaves at the midline may be diagnostically helpful. If it passes smoothly from the temporal into the nasal field without deflection, it is probably the result of a distortion of structures at the nerve heads. A distinct step at the midline occurs in association with chiasmal lesions.

R. W. Danielson.

Van Bogaert, L., and Van Leeuwen, A. First anatomic and clinical observations on the hereditary familial optic atrophy of Behr. *Bull. Acad. roy. de med. de Belgique*, 1942, v. 7, April, pp. 218-225.

The authors describe their observation of a patient with hereditary optic atrophy. From a pathologic study of the tissues they conclude that in the optic system the second neuron is degenerated in its entirety; the third is almost intact, the visual cortex normal. They do not mention the condition of the first neuron (bipolar cells) or the rods and cones. They found an associated cerebello-spinal degeneration of the Friedreich type. This disease is an essentially degenerative one and the types of Leber and Behr, are variations of the same heredo-familial degenerative process.

Jose Saenz Canales.

12

VISUAL TRACTS AND CENTERS

Brenta, J. and Danis, P. Bitemporal hemianopsia of traumatic origin. *Ophthalmologica*, 1946, v. 111, Jan., pp. 8-27.

The authors report in detail their observations of a patient with a post-traumatic chiasmal syndrome and thoroughly analyze their findings in the

light of data in the literature. In some cases direct mechanical trauma is the cause of the disturbances of vision and a sagittal tear of the chiasm that sometimes includes neighbouring tissues. In others a secondary process following the injury must be added to the mechanical effect and in a third category the secondary process alone produces the symptoms. It is obvious that the syndrome indicates an injury to the chiasm, but, since its appearance is apparently not dependent upon injury to the chiasm by a fragment of bone, its value in localising the fracture in the middle cerebral fossa is restricted. Its prognostic importance is dependent on the mode of origin. The investigation of visual disturbances must be continued over a long period; their increase may necessitate an operation in the area of the chiasma. (13 figures, references.)

F. Nelson.

Greear, J., and McGavic, J. Visual disturbances associated with head injuries. *Arch. of Ophth.*, 1946, v. 35, July, pp. 33-54.

The authors review the literature and report twelve cases of head injury in battle casualties. It was found that correlation of visual-field defects with definitely known sites and types of head injury, the notation of lesions found at operation and the results of roentgenographic examination of the skull offers the best method of studying the cortical representation of various areas of the retina. Cortical representation of the fixation area (macula) is similar to cortical representation of the peripheral portions of the retina. The fixation area is represented at the posterior tip of the occipital lobes, while the peripheral portions of the retina are represented in the cortex at

the anterior end of the calcarine fissure. Similarly, the upper half of the retina is represented in the cortex above the level of the calcarine fissure, while the lower half of the retina is represented below the calcarine fissure. Neither the fixation area (macula) nor the peripheral area of the retina has duplicate areas of representation. (References, 12 illustrations.)

R. W. Danielson.

Knapp, P., and Schwarzmunn, A. Contraction in the visual fields caused by a diencephalic lesion. *Ophthalmologica*, 1946, v. 111, April-May, pp. 270-278.

Concentric contraction of both fields of which the patient is unaware is a new symptom in diseases of the diencephalon. An illustrative clinical history is reported. The patient had the visual disturbance and endocrine and vasomotor changes such as hyperthyroidism, secondary amenorrhea, migraine, fainting spells, and acrocyanosis.

The anatomy and physiology of the diencephalon and the treatment are reviewed. (2 fields, references.)

Alice R. Deutsch.

Knüsel, O. Demonstration of visual fields in an opticochiasmal arachnoiditis. *Ophthalmologica*, 1946, April-May, v. 111, p. 298.

The author reports the clinical record of a patient with opticochiasmal arachnoiditis. The patient had headache, impairment of vision, and loss of weight after cranial injury. There was concentric contraction and a ring scotoma in the right eye, and concentric contraction and a central scotoma in the left.

Alice R. Deutsch.

Miranda, A. G. Binasal hemianopsia.

Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, June, pp. 472-492.

A case of an infiltrating subcortical glioma of the frontal lobe in a man 33 years of age is reported. The initial symptoms were headache, dizziness, and vomiting, followed rapidly by visual disturbances, bilateral choked discs, and a binasal hemianopsia. The diagnosis was confirmed surgically. The literature on binasal hemianopsia is reviewed, and reference made to Zeeman's publication in *Ophthalmologica* in 1943. The author concludes that binasal hemianopsia is a pathologic entity indicative of a lesion of the optic nerves in their intracranial portion, consecutive to a dilatation of the third ventricle, or to a parachiasmatic lesion. (12 illustrations.) Ray K. Daily.

Schlezinger, N., Alpers, B., and Weiss, B. Suprasellar meningiomas associated with scotomatous field defects. *Arch. of Ophth.*, 1946, v. 35, June, pp. 624-642.

Suprasellar meningiomas are characteristically associated with atrophy of one or both optic nerves and bitemporal hemianopsia. In almost all instances the symptoms are slowly progressive, with prominent visual loss and disabling headache. Not sufficiently well recognized as part of the suprasellar tumor syndrome is the occurrence of sudden visual loss with scotomas in the visual fields, associated with headache. The development of symptoms may be so rapid as to suggest the presence of retrobulbar neuritis.

Four cases of proven suprasellar meningiomas are reported with details of the physical findings, including visual fields. They illustrate the early occurrence of scotomatous field defects. The authors believe that the syndrome

of atrophy of the optic nerve with bitemporal visual field defects should be broadened to include the combination of optic nerve atrophy and expanding scotomatous field defects. In the absence of headaches and of deformities of the sella turcica, this syndrome is sufficient to warrant routinely the performance of complete examination of the spinal fluid and pneumoencephalography.

Since meningiomas are benign tumors and the suprasellar region is accessible to the neurosurgeon, an early diagnosis is desirable. (References, 9 figures.) John C. Long.

13

EYEBALL AND ORBIT

Giscard, A. Pulsating exophthalmos in pregnancy. *Ann. d'Ocul.*, 1946, v. 179, no. 2, pp. 108-111.

A woman, 21 years of age, in the sixth month of pregnancy noticed a sharp head pain during defecation. Prominence of the eye was observed together with a pulsation synchronous with the pulse. There was also dilatation of the periorbital veins and bulbar conjunctival vessels. Ligation of the common carotid was refused. During the fourth month of a subsequent pregnancy intracranial pulsation became more intense. A basal hysterectomy was performed under spinal anesthesia, and a vigorous baby of seven pounds was born. Fifteen months later the ocular symptoms were unchanged.

Charles A. Bahn.

Gruyton, Jack. Decompression of the orbit. *Surgery*, 1946, v. 19, June, p. 790.

Gruyton reviews the literature on the various surgical approaches to the orbit for its decompression. He compares the advantages and disadvan-

tages of the intracranial, sinus, and lateral approaches. He describes a technique for lateral orbital decompression which is a modification of the Shugrue operation described in Spaeth's textbook. He reports five patients operated on by this technique, two of them bilateral, with a reduction of the exophthalmus of 3 to 7 mm. He feels that this operation is the safest, has least danger of postoperative infection, and avoids the postoperative pulsation which often follows. (Bibliography.)

John B. Hitz.

Hanbery, J. W. **Orbital tumors.** Stanford Med. Bull., 1946, v. 4, May, pp. 52-62.

The most constant sign of intra-orbital tumors is unilateral exophthalmos. In the order of frequency of occurrence the growths are: blood vessel tumors, pseudotumors, meningiomas, osteomas, neurogenic tumors, sarcomas, dermoid and epidermoid cysts, lacrimal gland tumors, and xanthomas. The temporal transconjunctival, the lateral Krönlein, and the Dandy transfrontal approach are described. Twelve cases are reported. (3 tables and six figures.)

I. E. Gaynon.

Marcks, K., and Zugsmith, G. **Plastic repair of deformities of the socket and minor defects about the orbit.** Arch. of Ophth., 1946, v. 35, July, pp. 55-69.

As a preliminary to discussion of plastic repair the authors state that there are essentially four types of sockets, depending on the method by which the eye is removed. The sockets formed by enucleation of the globe without an implant, and those formed by enucleation of the globe and implantation of a sphere, are inferior to those formed by evisceration of the global

contents, removal of the cornea, closure of the sclera without an implant and coverage with conjunctiva. With the latter the motility and appearance of the prosthesis, are much better. The socket formed by evisceration of the ocular contents with an implanted sphere placed in the scleral sac, followed by closure of the sclera and conjunctiva undoubtedly gave the best results.

Associated with the alteration in function in the socket, various changes occur in the conjunctiva and the changes that occur after each type of removal are delineated. A discussion follows of the technique used in complete lining of the socket with skin, absence of conjunctiva, absence of inferior cul-de-sac, absence of cul-de-sac due to redundancy of mucous membrane, skin-mucous membrane combination, complications existing in socket repair, and atony of the lower lid.

Patients are going to be more and more critical of results, and surgery will need to be of the best. (7 illustrations.)

R. W. Danielson.

Orzalesi, Francesco. **Localized metastatic scleritis with exudative detachment of the retina.** Riv. di Oftalm., 1946, v. 1, Feb., pp. 73-84.

A woman, aged 47 years, developed a phlegmon of her left orbit with tenonitis, scleritis, iritis, and almost complete retinal detachment during the course of a severe furunculosis. Vision was reduced to the ability to count fingers excentrically at 50 centimeters. Sulfathiazole and autogenous vaccine, was used for treatment which was followed by complete reattachment of the detachment in five months and a visual acuity of 10/10. (References.)

K. W. Ascher.

Taylor, W. O. G. The nervous nasalis complex of Charlin. *Proc. Roy. Soc. Med.*, 1946, v. 39, March, p. 254.

A young African soldier admitted to an army hospital had suffered pain in his right eye for eight days. Blepharospasm and limbal injection were present. A preliminary diagnosis of iritis was made. Cultures, smears, and blood studies were all negative. Atropine and heat were prescribed.

Four days later beads of sweat gathered at the right side of the tip of his nose which reappeared within a few minutes after they were wiped away. Many fine postcorneal precipitates were seen on slitlamp examination.

Radiant heat therapy was of no avail. The eye became worse and the patient suffered reflex pain in the teeth and the head on the same side. Nerve block was performed by injections of 2 cc. of 3 percent novutox deep in the medial wall of the middle of the orbit. Early relief and complete cure occurred within ten days.

The author differentiates this syndrome of the nasal nerve from that of the pterygo-palatine ganglion.

F. M. Crage.

14

EYELIDS AND LACRIMAL APPARATUS

Barrenechea, S., and Contardo R. Dacryocystorhinostomy (Arruga's technique). *Arch. Chilenos de Oft.*, 1945, v. 2, Nov.-Dec., pp. 14-18.

Using the technique of Arruga, the authors operated on 43 cases, with 35 completely successful, 4 incompletely successful, and 4 failures. They conclude that this operation should be performed by preference in those young individuals in whom it is desired to preserve the lacrimal drainage channels

with avoidance of radical operations such as extirpation or destruction of the lacrimal sac. (2 statistical tables, 2 X-ray plates, references.)

W. H. Crisp.

Ferrié, J. Davis' grafts in reconstructive facial surgery. *Ophthalmologica*, 1945, v. 110, Nov.-Dec., pp. 292-299.

After surveying the various methods of autoplasty used in corrective face surgery, the author rejects some as unesthetic, and others as unreliable or incomplete. He favors the Davis method, for severe burns and for the correction of cicatricial ectropion of the upper eyelid. It is a simple method and gives satisfactory esthetic results. (3 photographs, references.)

F. Nelson.

McArthur, G. A. D. Some notes on West's operation. *Med. Jour. Australia*, 1946, v. 1, April 13, p. 508.

In 38 patients 42 sac operations were performed. Thirty-one patients were relieved and 35 operations were successful. Among the seven failures the eyes in two, previously constantly moist, were now almost constantly dry. The others were improved markedly.

The author feels that this operation should be performed by the rhinologist. General anaesthesia is required and where septal resection is necessary nasal packing for 24 hours is indicated. He feels that this operation is gradually supplanting sac removal except where cataract extraction is necessary. The West operation is considered the easiest in sacs with chronic infection where a good result can usually be predicted.

Francis M. Crage.

Mellick, A. Case of secondary

oblique facial cleft. *Brit. Jour. Ophth.*, 1946, v. 30, April, pp. 221-224.

An unusual case of partial oblique facial cleft in a soldier is presented. The defect consisted of a bridge of skin from the site of the upper canaliculus to the plica semilunars. The lower canaliculus was normal and patent. The defect is ascribed to an adhesion or pressure from an amniotic band. (4 illustrations.)

Morris Kaplan.

Pokhissoff, N. Treatment of eversion of the lacrimal puncta. *Ann. d'Ocul.*, 1946, v. 179, no. 1, pp. 41-49.

After a review of numerous operations, the following method is discussed in detail. After anesthesia of the inferior lid and its conjunctival lining two sutures are placed through the entire thickness of the lid at the internal angle. The lid is supported by a Jaeger lidplate. With a scalpel the conjunctiva is dissected under the lacrimal puncta to form a triangular flap with its base up. A second triangle is made, the base of which is the prolongation of the internal side of the first triangle. The base of this triangle is about 3 mm. long and the flap is situated 2 mm. from the lid border. These flaps form two Ls which are united; the obtuse angle interiorly, the acute angle exteriorly. The second flap is excised with scissors and the margins united with four or five sutures. The first reunites the angles of the two Ls, and the other sutures unite the margins of the horizontal wound. The sutures are removed three or four days later. The dimensions of the flap can be varied.

Six illustrative cases are described. Twenty-five operations were performed by the author; five binocular and twenty monocular. All patients

were observed at least ten months. (21 references.)

Charles A. Bahn.

deRoeth, Andrew. Penicillin in hordeolosis. *Northwest Med.*, 1946, v. 45, Sept., pp. 658-660.

Applications of penicillin in the form of ointment is advocated in recurring styes. Attention is drawn to the possibility of dermatitis following prolonged use. Applications of 2,000 units per c.c. are made for times a day for eight to fourteen days.

A. G. Wilde.

Stein, S. Treatment of chronic blepharoconjunctivitis with penicillin ointment. *Arch. of Ophth.*, 1946, v. 35, June, pp. 655-661.

The history, method of assay, and bacterial sensitivity of penicillin are reviewed. An ophthalmic ointment containing 100,000 Oxford units of penicillin in 7 grams of base was prepared with wool fat, petrolatum and water. This ointment, for all practical purposes, was stable at room temperature for one month.

Twenty-five patients with chronic blepharoconjunctivitis were treated with this ointment. A single daily dose containing 700 to 800 Oxford units was employed. All but two responded favorably to this treatment. The penicillin ointment has a decided advantage over drugs formerly used in the treatment of chronic blepharoconjunctivitis. There was no evidence of an allergic reaction to penicillin in the series of 25 cases. (References.)

John C. Long.

Ural, Z. Cases of Marcus Gunn phenomenon. *Oto-Nöro-Oft.*, 1946, v. 1, no. 2, p. 69.

Two cases of Marcus Gunn phenomenon observed in young men are reported. Both had ptosis of the left upper

lid. The author believes that this is significant.

F. H. Haessler.

15

TUMORS

Barraquer, M. B. A plexiform neuroma of the caruncle and the ciliary border. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, April, pp. 245-251.

A case of this rare tumor situated bilaterally on the caruncles, and ciliary border of the lower lids is reported. The diagnosis was made microscopically. A general examination of the 52-year-old woman revealed no other hereditary or congenital lesions. (7 illustrations.)

Ray K. Daily.

Cortez-Herman. Plasmoma of the conjunctiva. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, April, pp. 238-244.

A mass in the lid of a 21-year-old woman was found microscopically to be a plasmoma. It was successfully destroyed by diathermy. (6 illustrations.)

Ray K. Daily.

16

INJURIES

Aiello, G. Trinitrotoluene intoxication and ocular affections. *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 73, Jan., pp. 17-21.

The author presents and discusses the case of a 23-year-old female munitions worker presumably suffering from trinitrotoluene poisoning, who showed numerous small punctate and flame-shaped hemorrhages along the retinal vessels, low-grade secondary papillitis, a stellate figure in the macula, and eventually a large vitreous hemorrhage. No underlying systemic disease could be found (blood pressure was normal, examination of the urine was

essentially negative, and examination and tests for tuberculosis were also negative), but the possibility of the concomitant action of other toxic substances was admitted.

Harry K. Messenger.

Dufour, R. The X-ray localization of intraocular foreign bodies. *Ophthalmologica*, 1946, v. 111, April-May, pp. 310-314.

The author uses a 9-mm. metallic ring and a new graph which he superimposes on anteroposterior and profile X-ray exposures of the eye. The foreign body is exactly localized with compass and rule. Alice R. Deutsch.

Grana, P. C. Conjunctivitis and dermatitis due to "Beach apple." *Arch. of Ophth.*, 1946, v. 35, April, pp. 421-422.

Thirteen casualties were observed in troops stationed in Panama from the use of a poisonous plant, *Hippomane manchinella*, in camouflage. Within two hours of contact with the shrub excruciating pain developed in the eyes accompanied by excessive tearing, injection of the conjunctiva, and slight chemosis. The skin of the face showed a diffuse, patchy erythema and swelling. The use of dilute boric acid solution for the eyes and dilute sodium bicarbonate solution for the skin proved effective. The average stay in the hospital was three days, and no complications occurred.

John C. Long.

Hughes, W. F. Alkali burns of the eye. *Arch. of Ophth.*, 1946, v. 35, April, pp. 423-449.

This is a detailed review of the literature and summary of the present knowledge on this subject. Alkali burns are progressive in type, and serious late

complications frequently develop after little evidence of early injury. The severity of the lesion is less dependent upon the character of the cation than on the concentration of the alkali, the pH of the solution, and the duration of the exposure. In contrast to acid burns, the mucoid content of the cornea decreases.

Treatment effective for mild and moderately severe alkali burns consists of immediate irrigation with copious amounts of water or any bland solution, a thorough search and removal of any residual particles of alkali hidden within the conjunctival cul-de-sacs, followed by instillations of buffer solution (pH 4.5), instillation of mydriatics, use of 10 percent neutral ammonium tartrate (or lactate) after lime burns, instillations of sulfonamide or penicillin ointments to prevent secondary infection, and prevention of symblepharon. Early and repeated corneal paracentesis resulted in exceptionally good results in some reported cases. The early excision of necrotic conjunctival and episcleral tissue and its replacement with mucous membrane or conjunctival grafts has been employed in severe burns. Analysis of these reported cases does not reveal any striking benefit attributable to such a procedure. John C. Long.

Kutscher, C. F. **Ocular effects of radiant energy.** *Indus. Med.*, 1946, v. 15, May, p. 311.

After a preliminary discussion of the nature of radiant energy, its absorption by the tissues of the eye is discussed.

Infrared radiations longer than 30,000 Angstrom units are completely absorbed by the cornea; below this level corneal transmission increases slowly, and at 11,000 A.U., 96 percent

of the radiation is transmitted. The lens absorbs infrared between 18,000 and 10,000 A.U. The iris absorbs all infrared, translating this energy into heat which is dissipated either by the iris vessels, or by raising the temperature of the aqueous. Very little infrared radiation reaches the retina, and a thermal burn on this basis is very unusual.

All visible light (7,800 to 3,900 A.U.) is transmitted to the retina, where an excessive dose may produce a thermal burn. Ultraviolet light is absorbed by the lens, beginning at 3,800 A.U. Radiation the wavelength of which is 3,200 A.U. is completely absorbed. Below this level the cornea absorbs ultraviolet.

Only those radiations which are absorbed will produce biologic effects in tissues. Ultraviolet rays cause abiotic, or destructive effects after a latent period of some hours; infrared produces immediate thermal injury.

Corneal burns from infrared rays are uncommon, but show prompt diffuse opacification. More common is the so-called "glass-blowers" cataract, that appears in the posterior axial part of the lens after prolonged exposure to infrared (many years). Ultraviolet more frequently causes painful corneal injury, followed by fairly rapid recovery without residual damage.

Gamma rays produce cataract after several years' interval. Lens opacities have been observed after exposure to lighting or electric currents.

Treatment of these radiant energy injuries is discussed briefly.

Benjamin Milder.

Somerville-Large, L. B. **An operation for posterior route extraction of intra-ocular foreign bodies.** *Brit. Jour.*

Ophth., 1946, v. 30, April, pp. 208-213.

A method for the extraction of magnetic foreign bodies through the posterior route is described. Its essential characteristic lies in the use of a 1.5 mm. trephine opening through the sclera nearest the foreign body. The disc is dissected from the choroid which is punctured by diathermy or actual cautery. A point of the giant magnet is inserted. The conjunctiva is sutured over the trephine hole. No vitreous leakage or other complications occurred. The operation was carried out 24 times. (3 illustrations.)

Morris Kaplan.

Hertzberg, R. Quinine amaurosis, report of case. Med. Jour. Australia, 1946, v. 2, July 20, pp. 92-93.

The patient noted that after taking 50 grains of quinine sulfate, his vision became blurred and on the third day he was unable to see at all. Atabrine was substituted for quinine and the following day, vision began to return. The pupils were dilated and immobile, there was edema of the macula in each eye, and the fields were normal. Two days later the discs became pale and the arteries attenuated. After two weeks visual acuity was 6/6 and the pupillary reactions normal, although the vessels were still attenuated and the discs pale.

I. E. Gaynon.

17

SYSTEMIC DISEASES AND PARASITES

Argañaraz, Raul. Ocular manifestations of "sacred disease." Arch. de Oft. de Buenos Aires, 1943, v. 18, Nov., p. 546.

The author studied the ocular findings in seven cases of epilepsy. Most of the patients presented clinical evidence of other neurologic lesions. The ocular

findings consisted of enlargement of the blind spot, which was invariably found, constriction of the visual fields, congestion of the papilla, and optic neuritis or atrophy. The author points out that textbooks of ophthalmology fail to record ocular findings of significance in epilepsy and stresses the importance of the ophthalmologic examinations in the diagnosis of this disease. (Visual field charts.)

Plinio Montalván.

Barriere, L. A. Orbital miasis. Arch. de Oft. de Buenos Aires, 1943, v. 18, Nov., p. 585.

A case of orbital miasis in a 70-year-old man is reported. The lesion consisted of an extensive ulcerative process involving the lower lid and soft tissues of the cheek and penetrating deep into the orbital cavity. The globe was destroyed by panophthalmitis. After the removal of the larvae the lesions healed quickly leaving considerable granulation tissue. The life cycle of the larva and the mechanism of infestation are briefly discussed. (Illustrations and bibliography.)

Plinio Montalván.

Cullom, M. M. Role of sinusitis in eye pathology. Laryngoscope, 1946, v. 56, April, p. 164-179.

The author presents detailed case histories of 16 patients, each of whom showed unequivocal improvement of the ocular disease following radical sinus surgery. In each instance the sinusitis was sufficiently pronounced that it constituted a justifiable indication for surgical intervention. The eye diseases which improved included six ulcerations of the cornea, two retino-choroiditis, and four which were diagnosed as toxic amblyopia.

Benjamin Milder.

Knapp, Paul. Alopecia of one eyebrow. *Ophthalmologica*, 1946, v. 3, Feb.-March, p. 67.

A girl, 27 years of age, lost practically all the hairs of the left eyebrow after severe recurrent attacks of a neuralgia in the left side of her forehead. A normal condition was only restored after more than a year. A trophic disturbance, probably caused by an affection of the left ethmoid, might have been the reason for this unusual occurrence.

Alice R. Deutsch.

Pacheco-Luna, R. Notes on oncocerciasis in Guatemala. *Brit. Jour Ophth.*, 1946, v. 30, April, pp. 234-237.

A brief review of the picture of oncocerciasis is given. It is very common in Guatemala where it is estimated that 20,000 people are infected. Ocular manifestations are present in 30 percent and 2 percent are blind. The adult filaria are found in subcutaneous nodules about head and eyes. The microfilaria migrate from these tumors in the lymph channels. They are very easily seen in the corneal stroma, conjunctiva, and vitreous, and swim actively in the aqueous. The most distressing early symptom is photophobia which is followed by a punctate keratitis. Gradual sclerosis and atrophy follow. These signs and symptoms may persist for many years. The author observed one for 25 years. There is no treatment although extirpation of the subcutaneous tumors retards the spread of the disease.

Morris Kaplan.

Puig Solanes, Magin. Present condition of the clinical ocular problem of onchocercosis. Reprint from *Rev. Méd. del Hosp. Gen.*, 1946, v. 8, Feb., pp. 339-414.

The paper was presented to the Pan-American Congress of Ophthalmology at Montevideo in November, 1945. To some extent it repeats the material contained in the paper entitled "Onchocercosis in the State of Chiapas" (see below), utilizing 11 illustrations and over two pages of references, mostly Ibero-American.

W. H. Crisp.

Puig Solanes, M., Fontes, A., and Quiroz, J. A. Onchocercosis in the State of Chiapas. Reprint from *Rev. Salubridad y Asistencia (Mexico)*, 1945, July-Aug., pp. 69-96.

This paper summarizes the results of a clinical investigation in the onchocercosis zone of the State of Chiapas. A number of statistical details are given, together with 19 black and white photographic illustrations. The work is completed by a large and comprehensive statistical table.

W. H. Crisp.

Sala, G. Hepatolenticular degeneration (Wilson's disease) and ocular signs. *Riv. di Oftalm.*, 1946, v. 1, Feb., pp. 124-139.

A girl 13 years of age, with typical Wilson's disease, had bilateral Kayser-Fleischer corneal rings and very faint opacities in anterior polar region of the lenses. The latter were yellowish, and under the corneal microscope minute radial extensions of the same color were seen. The opacities were immediately beneath the lens capsule. Whereas Kayser and Fleischer described the corneal rings connected with "pseudosclerosis" in 1902 and 1903 respectively, the first case of Kayser-Fleischer's corneal ring associated with sunflower cataract was reported by Siemerling and Oloff, in 1922. The lens opacities, that are noted in patients with Wilson's disease, are very similar to those en-

countered in eyes with chalcosis. The diagnostic importance of both the Kayser-Fleischer ring and the sunflower-like lens opacity for the recognition of Wilson's disease is stressed, and the opinions as to the chemical constitution of these opacities are discussed. (References.)

K. W. Ascher.

Schmid, A. E. *Dysmorpho-dystrophia mesodermalis congenita*. *Ophthalmologica*, 1946, v. 111, Jan., pp. 28-60.

The author reports his investigation of a patient with this hereditary anomaly, her family tree, and a thorough analysis of the theoretical implications in the light of discussions of the subject in the literature. The patient, a girl, 17 years of age, had strikingly short fingers, hands, toes, and feet. In early childhood she had bilateral inguinal hernia, vaginal prolapse, scoliosis, and defective mobility of her joints. In each eye the lens was small, spherical, and ectopic. In the right eye it was luxated into the anterior chamber and in the left eye into the vitreous. In each eye there was atrophy of the iris with synechia and an anomaly of the optic disc. The patient is compared with a classmate who had arachnodactyly. Both conditions are inherited according to the same pattern and differ only in the length and width of body and extremities. Incomplete forms of both anomalies are more common than the fully developed symptom complex. The author suggests that the Marfan type be called dolichomorphy and the Marchesani type brachymorphy. Etiologically the condition is assumed to be a mesodermal dystrophy. (6 photographs, 7 drawings, 1 family tree, references.)

F. Nelson.

Tinelli, Giuseppe. The syndrome of Laurence-Moon-Bardet-Biedl. *Boll. d'Ocul.*, 1944, v. 23, Oct.-Dec., pp. 257-280.

A young man, 18 years of age, is described who had adiposo-genital dystrophy, esodactily of the feet, mental deficiency, hemeralopia, greatly reduced vision, convergent strabismus, vertical nystagmus, retinitis pigmentosa without pigment, and secondary optic atrophy. Metabolic investigations revealed that the diencephalic-hypophyseal system was affected. He was a son of consanguineous parents and one of his two brothers was mentally deficient. All similar cases reported in the literature are chronologically tabulated. The most important pathogenetic theories in this field are discussed. (Bibliography.)

Melchior Lombardo.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Blake, E. M. *Prevention of blindness*. *Conn. State Med. Jour.*, 1946, v. 10, May, Pp. 379-382.

The prevention of blindness is not a problem for the ophthalmologist only, but for the medical profession as a whole.

The incidence of ophthalmia neonatorum should be reduced to almost zero by modern preventive measures, plus chemotherapy and antibiotics.

With premarital blood tests and treatment with penicillin, blindness in childhood from syphilis should almost never occur.

During childhood and throughout adolescence the principal cause of blindness is accident. Accidents can only be prevented by education of

parents and children, and the continuous reiteration of "don'ts" with explanations of the reason for the "don'ts."

The greatest loss of vision, while not leading to blindness, but to great reduction in sight is in strabismus. Early ophthalmologic examination of all children, and treatment for strabismus where necessary is indicated.

Chronic simple glaucoma is the most important single cause of loss of sight today. The ophthalmologist should take the tension of the eye with a tonometer in all patients over 45 years of age.

There is not much hope of prevention of cataract as it is one of the manifestations of tissue senility.

In industrial medicine preemployment ophthalmologic examination is of importance both to employer and employee. The wearing of protective glasses in industry where the need is indicated, reduces the risk of accidents.

Theodore M. Shapira.

Galton, E. M. G. Ocular decompensation. *Brit. Jour. Ophth.*, 1946, v. 30, April, pp. 232-234.

The author compares ocular symptomatology with cardiac and finds them closely similar. In examining huge numbers of men in the armed services, it was seen that eyes which had previously given no difficulty suddenly caused much discomfort. Since the eyes had not changed anatomically, it was concluded that the neuromuscular system could no longer cope with the new mental and physical load and therefore became decompensated. Sometimes the mere prescribing of lenses aided, but most often the patient had to be treated as a complete medical entity. A plea is made for a continuation of this broad approach to ophthalmic problems.

Morris Kaplan.

Pereira Gomes. Study of the vision of drivers of vehicles. Reprint of paper presented before the fifth Congresso Brasileiro de Oftalmologia, 1946, June, 18 pp.

The author presents a partial review of the history of the subject, particularly as concerns the national traffic code in Brazil. The influence of monocular vision is considered as well as details relating to the light sense, dark adaptation, dazzling, hemeralopia, visual field, and tubular vision. Color sense is also discussed. The author concludes by making certain recommendations for amendment of the traffic code in Brazil, in relation to the vision of candidates for appointment in the capacity referred to. (References.)

W. H. Crisp.

Scalinci, Noè. The Italian contribution to the earliest knowledge of the structure and function of the retina. *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 73, Jan., pp. 58-59.

Fontana was the first to recognize fibers and cells in the retina, and, what is more important, to perceive that these elements are identical with those of cerebral nervous tissue. It was therefore not Langenbeck (1836) who first noted this identity, but Fontana about sixty years earlier. To Pacini (1845) belongs the priority for giving an approximately exact description of the minute structure of the retina. Golgi's chrome-silver technique of staining (1872-75) led to a more precise knowledge of the finer interrelations of the various layers, and to Tartuferi (1888) belongs the credit for introducing the new era in retinal histology.

The work of other Italians who also pioneered in this field receives brief mention. Harry K. Messenger.

Tisher, P. W. Opportunity for prevention of blindness in industry. Connecticut, M. J. 1946 v. 10, May, p. 382-383.

The losses in production and the human misery which result from industrial eye accidents, of which 90 percent are preventable, may be lessened by pursuing, for each factory, a blindness-preventing program which includes these features: enforced protective glasses; protective shields on machines; proper lighting; cleanliness; eye examinations; and job analysis.

Such a program will result in benefits to the manufacturers, as well as to the workers. Benjamin Milder.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Alexander, G. F. The elastic tissue within the eye. Trans. Ophth. Soc. U. Kingdom, 1944, v. 64, pp. 195-198.

The author states that Descemet's membrane splits into a number of sheets or lamellae which are inserted into the tip of the scleral spur. These lamellae with subjacent corneal lamellae constitute the pectinate ligament. They are non-distensible. The contraction of the radial fibres of the ciliary muscle pulls the choroid forward. The arrangement of the opening of the pectinate ligament produces a valve-like action, allowing the aqueous to percolate into the canal of Schlemm, but preventing any flow of blood into the anterior chamber during venous congestion.

He describes experiments which indicate that there is a definite hyaline membrane of the vitreous and that it is split into two layers. The anterior extends into the zonule of Zinn and the posterior forms the patellar layer. Be-

tween these two layers the canal of Petit is filled with aqueous.

Beulah Cushman.

Minton, J. Ophthalmic experiences in the east. Trans. Ophth. Soc. U. Kingdom, 1944, v. 64, pp. 199-209.

The author describes epidemic ophthalmias as seen in Iraq, Egypt, Palestine, India and Ceylon. The carriers of infection such as flies, dust, and sand and the lowered resistance of the children during the summer months seem to be factors in the development of the epidemics. Trachoma was prevalent and usually followed the epidemic ophthalmias. Syphilis was extremely common but interstitial keratitis was rarely seen. Cataract and glaucoma were found no oftener than in Europe but occurred at an earlier age.

The British troops had few infections, the Indian troops showed a much greater morbidity. The quiescent trachoma so frequently present in the Indian troops might account for some of the infections.

Sulfanilamide ointment was of great value in the treatment of trachoma and in the different types of conjunctivitis.

Beulah Cushman.

Offret, G. A review of modern studies concerning the physiology and psychophysiology of the parietal and occipital lobes of the brain. Arch. d'Ophth., 1946, v. 6, no. 2, pp. 145-172.

In this long article Offret gives a comprehensive review of the anatomy and functions of the parietal and occipital lobes. The many ophthalmologic aspects of the subject considered include anomalies of spatial orientation, reading, writing, color vision, and stereoscopic vision. Discussion of these subjects is preceded by a summary of

modern anatomical knowledge in which numerous references to current literature are made although the author has not provided a bibliography. This valuable article does not lend itself to review but should be read in its entirety.

Phillips Thygeson.

Swan, Charles, and Tostevin, A. L. Congenital abnormalities in infants during pregnancy, with special reference to rubella. *Med. Jour. Australia*, 1946, v. 1, May 11, pp. 645-659.

All important data are presented in tabular form and an analysis is presented in the text. In this investigation 56 infants and two fetuses were examined; 46 of them were found to have congenital malformations. In 40 instances, the mothers had rubella; 36 of the infants had congenital defects which with few exceptions were more or less complete reproductions of the syndrome that consists of cataract, deafmutism, heart disease, and microcephaly. In two instances in which rubella was contracted less than two weeks before conception, the infants were normal. In the remaining 16 in-

stances the mothers were ill during pregnancy with morbilli, mumps, varicella, herpes zoster, and scarlatina, and nine of the infants were abnormal.

The development of defects is elucidated on the basis of Stockards experimental studies of eggs of the minnow. The type of abnormality is determined by the particular developmental moment at which the noxa acts. Fetal tissues are susceptible to injury by virus infections and those Anlagen which are in a stage of rapid growth are most vulnerable. It has been stated that if maternal infection occurs in the first six weeks of pregnancy, fetal injury will be widespread. After eight weeks the eyes, heart, and semicircular canals may escape, but the cochlea is still vulnerable. After the third month damage to the fetus is rare. In the light of the data presented by Swan and Tostevin, this view must be modified. There must be other factors at work in determining whether a particular primordium is affected even if it is rapidly proliferating, and has developmental "precedence" over the other centers of growth. I. C. Gaynon.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. George Franklin Libby, Fillmore, California, died September 13, 1946, aged 78 years.

Dr. Claude Worth McKee, Greensburg, Pennsylvania, died September 11, 1946, aged 70 years.

Dr. Edward Brent Mitchell, Lawton, Oklahoma, died August 13, 1946, aged 78 years.

Dr. Harold Vincent Phelan, Cleveland, Ohio, died September 1, 1946, aged 51 years.

Dr. Edward Francis Ritter, Jr., Chicago, Illinois, killed in action in the Asiatic area, October 24, 1944, aged 35 years.

Dr. Theodore Lasater Terry, Boston, Massachusetts, died September 28, 1946, aged 47 years.

MISCELLANEOUS

HEED OPHTHALMIC FOUNDATION

The Heed Ophthalmic Foundation is now offering a limited number of fellowships for advanced training in ophthalmology. Only those who have completed a minimum of two years' specialized study in ophthalmology are eligible. United States citizenship is required.

For further details, refer to an editorial appearing on page 79 of this Journal and in the current *Transactions of the American Academy of Ophthalmology and Otolaryngology*.

Application blanks and additional information may be obtained from the Secretary of the Board of Directors, Dr. M. Hayward Post, 520 Metropolitan Building, 508 North Grand Boulevard, St. Louis 3, Missouri.

FRANCIS I. PROCTOR LABORATORY

The Division of Ophthalmology of the University of California announces the establishment of the Francis I. Proctor Laboratory for Ophthalmic Research. A sum of over \$500,000 from the estate of Dr. Proctor was set aside and given by Mrs. Proctor for this purpose. In addition, as previously announced, Mrs. Proctor has donated a sum of \$20,000 for the establishment of the yearly Francis I. Proctor Lecture on Ophthalmology to be given at the University of California.

Mrs. Berthold Guggenheim has guaranteed a sum of \$65,000 for the construction of a laboratory of 3,000 square feet in the new science building which is to be constructed on the medical school campus as soon as building again becomes feasible. In the interim the laboratory is being housed in temporary quarters.

Dr. Michael Hogan has been appointed director of the Proctor Laboratory.

The plans call for research in the various branches of ophthalmology as soon as facilities are available. In the development of the laboratory, the director and the staff will be aided by the advice and experience of Dr. Phillips Thygeson, who is now a member of the visiting staff.

EYE BANK APPOINTMENTS

The Board of Directors of The Eye Bank for Sight Restoration, Inc., announces the following scholarship and fellowship awards and appointments:

Dr. Herbert M. Katzin, New York, has been put in charge of the Laboratory for Ophthalmic Research of The Eye Bank for Sight Restoration, Inc.

Dr. Frank Constantine has been granted a Fellowship to pursue studies in relation to corneal vascularization.

Dr. Arnold Forest of the Army Institute of Pathology, Washington, D.C., has been granted a Fellowship for training in Ophthalmic Pathology with special emphasis on corneal pathology.

Dr. Milo H. Fritz of New York has been granted a Fellowship to continue studies in vitreous replacement and vitreous transplants.

RESEARCH PROGRAM OF COMMITTEE ON VETERANS' MEDICAL PROBLEMS

At a conference suggested by the Surgeon General, U. S. Army, and attended by representatives of the Chief Medical Director, Veterans Administration, and of the Surgeons General of the U. S. Army, Navy, and Public Health Service, the National Research Council was asked to explore the value and feasibility of a long-term program of follow-up study and clinical research. The report of this investigation was approved by the above agencies and at the request of the Chief Medical Director, Veterans Administration, the National Research Council has appointed a Committee on Veterans' Medical Problems.

The purpose of the Committee is to plan and carry out a medical research program utilizing the wealth of material accumulated during World War II so that the care of patients, the investigation of disease, and the improvement of medical practice and education may be advanced. Medical records of service personnel will be available to accredited representatives of the National Research Council when working on studies approved by the Army, Navy, or Veterans Administration.

The program, dealing with medical problems of veterans and of the armed forces, will include projects of three types: (1) clinical follow-up studies; (2) original investigations which may be carried out in Veterans Administration hospitals or other institutions; and (3) statistical studies on mortality and duration of disability.

The Committee will consider proposals for studies originating from the Veterans Administration, the U. S. Army, Navy, Public Health Service, National Research Council, universities, or other workers. Proposals will be referred to advisory committees of the National Research Council for detailed analysis, after which they will be evaluated by the Committee on Veterans' Medical Problems. Carefully established criteria will be followed, emphasis being placed upon significant long-term research or shorter problems which fit well into the Committee's overall program. The present program is financed by contract with the Veterans Administration. It is hoped that funds will be available for grants in the spring of 1947.

The Committee will attempt to evaluate and assist medical studies of direct or collateral importance to veterans. At the request of the Veterans Administration, it will analyze all proposals for medical research submitted to that agency, whether or not financial support under the Committee's program is needed. In the case of medical officers of the Veterans Administration, Army, or Navy, application forms may be obtained and returned through the appropriate channels. Other agencies or individuals may obtain the forms from, and submit them directly to the Committee on Veterans' Medical Problems, Division of Medical Sciences, National Research Council, 2101 Constitution Avenue, Washington 25, D.C.

After approval of a project, the Committee Office at the above address will offer, when requested, such special services as it is able to render. These will include facilities for statistical planning, aid in securing medical records and preparing rosters, assistance in locating veterans for follow-up studies, and help in analysis of the results obtained.

(Editor's Note. Ophthalmic ex-medical officers have in many instances kept careful records of the patients whom they saw during their military service, and the above plan offers these ex-medical officers an opportunity to carry out what may well be exceedingly valuable clinical follow-up studies on these patients. You are urged to write to Dr. John C. Ransmeier, Medical Executive, Division of Medical Sciences, National Research Council, 2101 Constitution Avenue, Washington 25, D.C., and send him your lists containing the names of individuals who passed through your hands and the kind of diseases or injuries involved.)

GLAUCOMA PRIZE OFFERED

The National Society for the Prevention of Blindness announces that papers submitted for the glaucoma prize of \$500 offered in 1944 did not conform to the criteria set up by the ophthalmic committee selected to award the prize. Therefore, the prize is again offered for the most valuable original paper adding to existing knowledge about the diagnosis of early glaucoma or to the medical treatment of non-congestive glaucoma. The criteria may be obtained by writing to the National Society for the Prevention of Blindness, 1790 Broadway, New York 19, New York.

Papers may be presented by any practicing ophthalmologist of the Western Hemisphere and may be written in English, French, German, Italian, Spanish, or Portuguese. Those written in any of the last four languages should be accompanied by a summary in English. Closing date for receipt of papers is December, 1947.

The award will be made by the Society with the guidance of an ophthalmic committee composed of Drs. John N. Evans, chairman; Frank C. Keil, Daniel B. Kirby, John M. McLean, R. Townley Paton, Algernon B. Reese, Bernard Samuels, Kaufman Schlivek, Willis S. Knighton, Manuel Uribe Tróncoso, and David H. Webster.

SOCIETIES

On November 19, 1946, the New England Ophthalmological Society participated in the program of the annual meeting of the Massachusetts Eye and Ear Alumni Association. The program included: Morning Session—Surgical Clinic conducted by the Eye Staff of the hospital; Afternoon Session—Prof. W. J. B. Riddell, Glasgow, Scotland, delivered the Howe Lecture. His subject was, "Heredity and Variation in Clinical Ophthalmology."

At the evening session—the 372nd regular meeting of the New England Society—Dr. Howard F. Hill presided. Elek J. Ludvigh, Ph.D., of the Howe Laboratory of Ophthalmology, presented a paper on "Visual Acuity Tested with Moving Objects." Prof. W. J. B. Riddell spoke on "Ophthalmological Education."

The second day's meeting opened with a Surgical Clinic. Dr. Frederick H. Verhoeff presided at the afternoon session. The program included:

"Di-isopropyl Fluorophosphate in Glaucoma." Edwin B. Dumphy, M.D.

"Aniseikonia." John P. MacNie, M.D.

"Conjugate Deviation of the Eyes on Forced Closure of the Lids. Its Neurologic Significance." David G. Cogan, M.D.

"Nutritional Retrobulbar Neuritis." Frank D. Carroll, M.D.

"Spectral Absorption Measurements of the

Refractive Media of the Eye." V. Everett Kinsey, Ph.D.

"Ocular Injury Due to Sulphur Dioxide." W. Morton Grant, M.D.

"Congenital Cataracts." Francis J. West, M.D.

At the November dinner meeting of the Cleveland Ophthalmological Club, Dr. Paul A. Chandler, assistant professor of ophthalmology in the School of Medicine of Harvard University, Boston, gave a most instructive and interesting paper on "Neglected Cause of Secondary Glaucoma in Which the Lens Is Absent Or Dislocated."

The annual meeting of the Ophthalmological Society of Egypt will take place at the Memorial Ophthalmic Laboratory, Giza, Egypt, on Friday and Saturday, March 14 and 15, 1947.

The following ophthalmic papers were presented before the Section on Ophthalmology and Otolaryngology of the Southern Medical Association in Miami, Florida, on November 6, 1946:

"Causes of Failure in Glaucoma Operations." Brittain Payne, M.D., New York (by invitation).

"Separation of the Retina—Technic and Results." W. R. Buffington, M.D., Louisiana.

"A New Syndrome: Vertical Phorias with Endocrine Dysfunction." E. H. Coachman, M.D., Oklahoma.

"Migraine as Seen by the Ophthalmologist." F. A. Holden, M.D., Maryland.

"Exophthalmos in Relation to Orbital Tumors. Report of Six Cases." S. B. Forbes, M.D., Florida.

The first meeting of the Washington, D.C., Ophthalmological Society for the 1946-1947 season was held November 4, 1946, and was a joint session with the Baltimore Ophthalmological Society. Dr. Richard W. Wilkinson, president of the society, presided during the meeting.

Case presentations were made by Dr. Edward J. Cummings on "Cataracta Neurodermatica," and "Vitreous Cyst." Dr. Jules B. Chapman presented a case on "Cataracta Complicata."

The guest speaker of the evening was Prof. W. J. B. Riddell of the University of Glasgow, Scotland. His presentation was on the "Clinical Valuation of Cataract Operation." Discussion on this interesting paper was made by Dr. Clyde A. Clapp of Baltimore and Dr. John W. Burke of Washington.

The next meeting of the society is scheduled for January 6, 1947.

The next meeting of the Pennsylvania Academy of Ophthalmology and Otolaryngology will be April 26 and 27, 1947, at the Penn-Harris Hotel, Harrisburg.

The Central Illinois Society of Ophthalmology and Otolaryngology held its sixth meeting at the Hotel Pere Marquette, Peoria, Illinois, on November 30 and December 1, 1946. The following ophthalmic papers were presented at the meeting:

"Partial Tendon Transplantation of Eye Muscles for Incurable Paralysis," Harry W. Woodruff, M.D., Joliet.

"Differential Diagnosis of Ocular Proptosis," Derrick Vail, M.D., Chicago (by invitation).

"Errors in Cataract Surgery," Watson Gailey, M.D., Bloomington.

"Surgical Management of Glaucoma and Glaucoma Problems," Derrick Vail, M.D., Chicago.

Guest speaker at the meeting was the Hon. Dwight H. Green, Governor of the State of Illinois. New officers elected for the year, 1947, include: President, Walter Stevenson, M.D., Quincy; president-elect, Clarence E. McClelland, M.D., Decatur; vice-president, Clifton S. Turner, M.D., Peoria; secretary-treasurer, William F. Hubble, M.D., Decatur.

PERSONALS

Dr. Phillips Thygeson, who since his discharge from the Army has located in San Jose, California, is now on the visiting staff of the University of California Medical School in San Francisco. Dr. Thygeson spends two days a week at the university carrying on his research work under funds from the Charles Taylor Reeves and Mrs. E. S. Heller donations. He has also been appointed to the staff of the Hooper Research Foundation.

Dr. John L. Scales, of Shreveport, Louisiana, announces his retirement after 50 years of active practice. At a reception in the Woman's Club on Sunday, November 3, 1946, some 500 guests, most of whom were physicians and their wives, paid their respects. Others present were members of the official boards of the various civic organizations of which Dr. Scales is a member, including the official board of Centenary College, and close friends.

Outstanding among those of the eye, ear, nose, and throat profession, Dr. Scales has endeared himself to an unusually large clientele, and because of his reputation for fair dealing, to all of his colleagues. Few physicians have been of such inestimable value to their communities, and news of his retirement comes with sincere regret.

Dr. William B. Clark, head of the department of ophthalmology, Tulane University of Louisiana School of Medicine, returned to Guatemala on November 7, 1946, where he concluded the research project on onchocerciasis that he began there last year.



AN INVITATION TO OPHTHALMOLOGISTS

The aim of the Guild of Prescription Opticians is to advance the science of ophthalmic optics through the development of a country-wide dispensing optical service which comprehensively meets the needs of the Eye Physicians and their patients and truly renders the most efficient form of services in eye care. The continued growth of this Guild is evidence of the success with which these unrelenting efforts have been accorded recognition.

Ophthalmology has evidenced its recognition of the important part Guild service has played in eye care because many of its members have joined at the suggestion and on the request of eye physicians.

The Guild extends to eye physicians an invitation to recommend dispensing opticians in their community who, in their opinion, conform to Guild principles. Full requirements for membership will be furnished upon request.

MEMBERSHIP COMMITTEE

Guild of Prescription Opticians of America

1218 CHESTNUT STREET, PHILA. 7, PENNA.

 Guild of Prescription Opticians of America, 1218 Chestnut Street, Philadelphia 7, Penna.

Name of suggested member.....

Address.....

City.....State.....

(signed)..... M.D.

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OCULAR HISTOPATHOLOGY OF SOME NAGASAKI ATOMIC-BOMB CASUALTIES*

T. F. SCHLAEGEL, JR., M.D.
Indianapolis

While stationed near Fukuoka, Japan, I had the opportunity of visiting the ophthalmological clinic of Kyushu Imperial University where the Japanese staff was involved in a study of the effects of the atomic bomb upon the eye. Although too late for a study of the clinical effects, I did arrive at the time of the pathologic investigations and was given sections of eyes obtained at autopsy. A study of these sections forms the basis of this report.

MATERIALS AND METHODS

None of the eyes studied clinically in Nagasaki were available for histopathologic study, but some were obtained at autopsy from patients who had died in other departments of the university as a result of the radiation sickness. I was given one to three sections each of six eyes of different patients plus one section of a lens, all stained with hematoxylin and eosin.

Unfortunately only one short clinical history on these patients was available (table 1), but it is typical, and aplastic anemia was an almost universal finding.

HISTOLOGIC CHANGES FOUND AT AUTOPSY

Changes seen in the cornea and lens are apparently due to the direct effects of

radiation, while the findings in the rest of the eye appear to be secondary to the systemic condition. The positive histopathologic features are presented by cases. The numbering of these cases follows that of the ophthalmological clinic of Kyushu Imperial University.

TABLE 1
CLINICAL DATA ON THE 7 ATOMIC-BOMB CASES
SUBJECTED TO HISTOPATHOLOGIC STUDY

Number	Sex	Age	Eye	Days from Bombing to Time of Death
3	♂	30	OD	29
4	♀	—	OD	29
7	♀	7	OS	29
10	♀	36	—	30
15	♂	47	OD	32
27*	♀	54	OS	27
12	♀	19	OS	30

* Additional information is available on this case. It is reported not only for itself but also because it is roughly typical of the general clinical course. The original complaint was contusion of right leg. The history showed that the patient lived in wooden house 2 km. from the center of the bombing. For three days following the explosion, she vomited bilelike material and complained of anorexia and weariness. Epilation developed on August 15th. From August 31st on, she ran a fever of about 39.4°C. and had diarrhea. On admission to the surgical clinic September 3rd, she complained of pain in the entire abdomen. On September 4th she developed petechiae; the next day, she developed dyspnea and died. Laboratory findings were: Hemoglobin, 55 percent; erythrocytes, 1,790,000; leukocytes, 1,000. Autopsy showed: Petechiae of entire body, ulcer of right leg, epilation of head, ulcer of rectum; pulmonary hemorrhage, turbidity of parenchyma of liver and kidney, atrophic gastritis, slight enlargement of spleen, and adhesive fibrosis of pleura.

*From the Research Division and the Department of Ophthalmology of the Indiana University Medical Center.

CASE 3 (SLIDES A AND B)

Lens. Small vacuoles are seen under the anterior lens epithelium (fig. 1A), and in Slide B at one equator and at the posterior pole.

Choroid. There is a mild, loose, cellular infiltration, consisting mainly of small



Fig. 1 (Schlaegel). Case 3. A, There is a stratum of small vacuoles in the superficial anterior lens cortex. B, There is a mild, loose infiltration of mononuclear cells in the choroid (septic choroiditis).

lymphocytes, located in the posterior half of the choroid (fig. 1B).

CASE 4 (ONE SLIDE)

Lens. Small vacuoles in the lens cortex near its surface are seen anteriorly and posteriorly.

Choroid. There is a mild, loose cellular infiltration, consisting mainly of small lymphocytes, present in the posterior part of the choroid.

CASE 7 (SLIDES A, B, C)

Lens. Small vacuoles in the cortex at the equator are seen in two of the sections.

Ciliary body. In Slide B there is a mild edema of the ciliary processes.

Choroid. There is a moderate, loose mononuclear infiltration especially at the posterior pole.

CASE 10 (SLIDES A AND B)

Cornea. The epithelium is denuded

centrally, but peripherally a single layer of cells is present, probably representing regeneration (fig. 2A). A layer of fibrin containing bacilli is seen on the endothelial surface. These bacilli are single, stain faintly, and vary from 7 to 10 micra in length. There is a mild round-cell infiltration of the subconjunctival tissue at the limbus.

Iris. In Slide A there is edema with a mild, loose, round-cell infiltration.

Lens. In both slides a few anterior subepithelial vacuoles are seen.

Ciliary body. The vessels are packed with disintegrated leukocytes. There is a massive serous exudate in the suprachoroidal space. There are bacilli in the ciliary processes, a pink-staining edema of the superficial layers, and a layer of serous exudate on the ciliary epithelium.

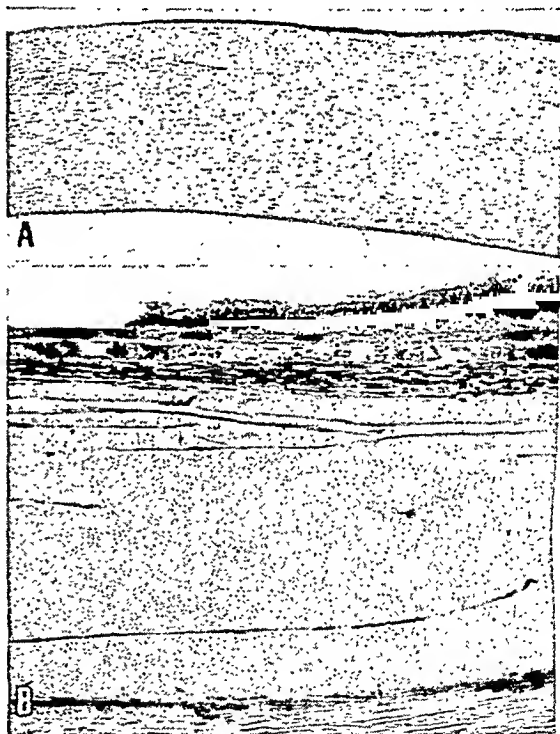


Fig. 2 (Schlaegel). Case 10. A, The corneal epithelium is denuded centrally, but a single layer of cells from the periphery may represent regeneration. B, At the ora serrata is seen a massive serous exudate in the meshes of the suprachoroida extending under both the ciliary body and choroid.

Vessels of the flat portion of the ciliary body are filled with blood that has undergone autolysis.

Choroid. The massive serous exudate lying in the meshes of the suprachoroida extends back beneath the choroid (fig. 2B). The vessels of the choroid are filled with blue-staining granular material (probably autolyzed leukocytes). Bacilli of different sizes are seen in the large veins.

CASE 15 (SLIDES A AND B)

This eye presents a striking picture in that all the vessels are extremely distended by white cells. These leukocytes do not appear immature, and although there are polymorphonuclears and lymphocytes present, the great majority are mononuclear cells, the larger of which resemble macrophages. There is also a striking lack of erythrocytes, the white cells outnumbering them 10 to 1.

Cornea. The epithelium has been desquamated but appears to be regenerating. Fibrin fills much of the anterior chamber.

Sclera. Vessels of the sclera and episclera are packed with the white cells mentioned previously.

Iris. The vessels extending from the iris root are similarly distended.

Lens. There are anterior subepithelial vacuoles in the cortex. In Slide B numerous colloid excrescences are seen under the posterior capsule.

Ciliary body. The vessels of the entire ciliary body are packed with the leukocytes mentioned (fig. 3A).

Choroid. The most striking change is the severe distention of vessels by the same type of leukocytes (fig. 3B-C).

Optic nerve. At the disc the vessels are congested with the white cells, and along the nerve septa these cells appear to be mainly intravascular (fig. 3C).

Vitreous. It is of a definitely fibrillar

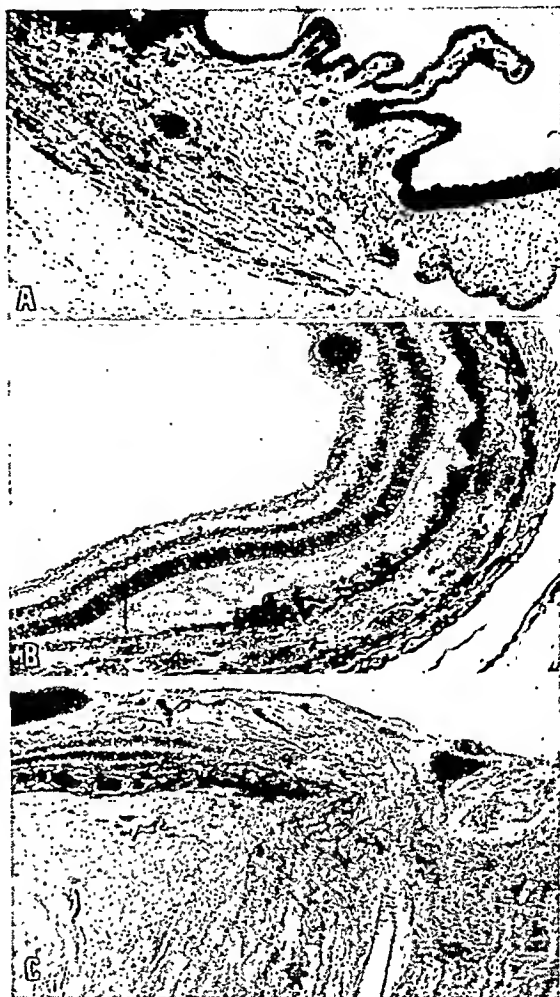


Fig. 3 (Schlaegel). Case 15. The vessels of the entire eye are distended with leukocytes, mainly mononuclears. A, Ciliary body. B, Retina and choroid. C, Retina, choroid, optic disc, and nerve.

structure complicated by the presence of fibrin in the region of the posterior retina.

Retina. The entire retina is atrophic and its vessels are distended with the cells described (fig. 3B).

In Slide A, five nodules of leukocytic, mainly round-cell, infiltration of the retina are seen (fig. 4). The pigment epithelium is disintegrating in many areas.

CASE 27 (SLIDES A AND B)

There is an invasion of the entire eye by streptobacilli plus an incidental old



Fig. 4 (Schlaegel). Case 15. A nodular leukocytic infiltration of the retina bulges up the internal limiting membrane.

iritidocyclitis with secondary glaucoma. The streptobacilli are extremely long consisting of up to 20 visible sections, each varying from 6 to 10 micra in length. They stain darkly with hematoxylin and have sharply sawed-off ends.

Episclera. It presents a mild leukocytic infiltration.

Iris. In Slide B, pigment granules, streptobacilli, protein exudate, and round cells are seen in anterior and posterior synechiae.

Lens. Streptobacilli are seen on the posterior surface in a serous exudate stretching from ciliary body to ciliary body (fig. 5A). There are small vacuoles under the anterior epithelium.

Ciliary body. The ciliary processes are atrophic. A thick layer of serofibrinous exudate is seen on the surface of the ciliary body and an inflammatory edema with streptobacilli is seen in the superficial portion.

Choroid. Long strands of morphologically identical streptobacilli are seen lying in the stroma and in the vessels amidst a mild edema.

Optic nerve. There is evidence of slight atrophy of the nerve with an increase of



Fig. 5 (Schlaegel). Case 27. A, Streptobacilli lie on the posterior surface of the lens in a serous exudate. B, A clump of streptobacilli in the inner retina lies under a heavy fibrin net three times as thick as the retina (only part of the net is shown).

neuroglial nuclei and apparent thinning of nerve-fiber bundles. The cribriform plate curves backward.

Streptobacilli are seen among the nerve and septal fibers. Colloid excrescences are present on the inner surface of the lamina vitrea which stretches across the optic-nerve head in this peripheral section.

Vitreous. Several large preretinal fibrin nets are seen.

Retina. Streptobacilli lie in the ganglion cell and nerve-fiber layers (fig. 5B). A cystoid degeneration at the ora serrata involves both layers. (The age of the person in this case was 54 years.)

CASE 12 (ONE SECTION OF LENS)

The entire lens is shrunken. Relatively

large vacuoles are present in the anterior cortex and a few are seen in the posterior cortex. At one equator in a deeply pink-staining homogeneous material are found a number of large vacuoles. This pink material is probably albumin which has exuded from the lens fibers and collected under the loosened and wrinkled capsule as a postmortem phenomenon.

COMMENT

CORRELATION OF REPORTED CLINICAL FINDINGS WITH HISTOPATHOLOGY

It has always been difficult to correlate clinical findings with those of the microscope. The following comments will be in the nature of speculation, especially since none of the eyes observed clinically were available for pathologic study.

In general the damage to the eyes was less than that to other organs. The usual blast and foreign-body injuries were seen early but with the unique addition of burns from infrared and ultraviolet rays.¹

Cornea. Conjunctivitis and superficial keratitis were found in many of the patients, but the effects disappeared in about a month.¹

In some of the sections (one month after bombing) there is found a denudation of the epithelium with regeneration. This corneal damage was apparently due to the direct effects of irradiation and was clinically considered due to ultraviolet rays.¹

Sclera. Episcleritis in conjunction with corneal infiltration was found in some cases.¹

Although there is no stromal damage, an occasional infiltration of the episclera by leukocytes is seen.

Iris. There is no report of clinical involvement, and in only one case is there a mild edema and cellular infiltration.

Lens. Flick,² using an ophthalmoscope, found no cataractous changes. Professor Shoji (Tokyo) in a letter to Ikui said

that after examining the patients in Hiroshima he found one cataract that developed 40 days after the bombing. Experimentally it has been demonstrated that changes appear histologically before they can be detected clinically.

There are variations in the reported histologic findings, but the following arbitrary outline will serve as a guide for comparison.

REPORTED LENS CHANGES OBSERVED

1. Vacuoles in both the anterior and posterior subcapsular cortex.³ The size of vacuoles in these cases is greater than that commonly seen in routine eye sections, but less than that frequently reported.

2. Vacuoles are at first discrete but later coalesce to form plaques.⁴ In the sections they appear to be in the process of forming plaques.

SOME REPORTED LENS CHANGES NOT OBSERVED

1. Later there is a knotty swelling of fibers at the equator which extends over the entire posterior cortex.³

2. A change in the curve of the lens epithelium and a movement of nuclei backward to form a pseudoepithelium.³

3. Metaplasia of the anterior epithelium.^{3, 5}

These changes not observed are late alterations and would not be expected after one month. In man the latent period for irradiation changes has varied from 9½ months to 8 years,⁶ and even in experimental animals it has never been as short as one month, as far as I can determine.

According to Rohrschneider, no lens changes can be produced with less than an epilation dose of irradiation, but Lebensohn⁷ and Kandori⁸ maintain that they can. Epilation was common among the Nagasaki people with irradiation sickness,

so it appears very possible that these eyes sectioned received a dose sufficient to produce radiational cataract, but time for complete development had not elapsed.

From the standpoint of roentgens it is impossible to state whether the computed 473r at 1,250 meters⁹ was sufficient to cause cataract, for roentgens are not a reliable index of biologic effect, and we

cut, although they appear to be from near the axis. The fact that the measurements at the equator are less than those of the reported normals may indicate that there is no error from over measurement.

Another check on the figures obtained is to compare them with Fincham's diagrammatic construction of the lens capsule.¹² From Table 2 we find a 50-percent

TABLE 2

LENS CAPSULE THICKNESS IN MICRA SEEN IN 13 SLIDES OF 7 CASES OF ATOMIC-BOMB CASUALTIES COMPARED WITH THE NORMAL THICKNESS (SALZMANN) FOR THE SPECIFIC AGE

Case and Slide	Ant. Pole*	Normal	Equator	Normal	Post. Pole*	Normal
3A	18	11	10.5 & 14.0	13	12.0	3.0
3B	18	11	12.0 & 13.0	13	4.5	3.0
4A	18	—†	10.5 & 12.0	—†	4.0	—†
7A	12	8	6.0 & 5.0	9	13.5	2.0
7B	18	8	12.0 & ‡	9	‡	2.0
7C	8	8	6.0 & 6.5	9	3.5	2.0
10A	15	9	12.0 & ‡	16	‡	3.4
10B	12	9	11.5 & 9.0	16	‡	3.4
15A	20	11	15.0 & 14.0	15	6.0	3.4
15B	15	11	15.0 & 15.5	15	3.0	3.4
27A	21	14	10.0 & ‡	16	15.0	3.0
27B	15	14	8.0 & 12.0	16	15.0	3.0
12	15	12	10.5 & 12.0	17	9.0	3.0
Mean	15.8	10.5	11	13.7	8.6	2.9

* The anterior and posterior extremities of the lens were considered the respective poles. This assumption introduces an error which is discussed.

† Unknown because age of patient is unknown.

‡ Not measurable because of indistinctness or absence.

have only one short clinical history. It is known that gamma radiation is very apt to produce cataract,¹⁰ and gamma rays were present at Nagasaki.⁹

Experimentally, the anterior capsule may become thickened to twice the normal size.⁴ A study of the thickness of the capsule of these Nagasaki cases was made and the figures obtained compared to those of Salzmann¹¹ (see table 2). The anterior and posterior extremities of the lens were considered the respective poles and measurements were also taken at both equators. The assumption that we are dealing with sections through the poles introduces an error, for it is impossible to tell exactly where the sections were

increase in thickness of the anterior capsule over that of the normal at the pole. If we consider the figure as indicative only of eccentricity of the sections, we find that its 50-percent increase in thickness corresponds to a point about 1.3 mm. from the center of the lens. From their appearance it is probable that my sections were cut in roughly this area. At the same distance from the axis on the posterior capsule, we may compute that the thickness of the capsule is at least 200 percent greater than would be expected. It appears safe to conclude that the posterior capsule is thickened, but the apparent increase in thickness of the anterior capsule is in the realm of error be-

cause of the eccentricity of the sectioning.

It is obvious that the lens picture bears only slight resemblance to the reported changes in roentgen-irradiation cataract. The evidence we do have rests on the findings of small vacuoles in the superficial cortex and a thickening of the posterior capsule. (It is the anterior capsule which has been reported as becoming thickened, and anoxia may have played a role in the production of the lens vacuoles.)¹³

Although the evidence is inconclusive, we could expect little change after only one month. It will be interesting to see what later clinical and histologic studies of the atomic-bomb survivors will show in respect to the development of irradiation cataract.

Ciliary body. Degeneration of the ciliary epithelium observed experimentally⁸ was not seen.

A mild edema of the superficial loose tissue was commonly present, and in the last three cases a serous cyclitis was observed. In Case 10 there was a serous detachment of the ciliary body and choroid of severe degree. The serous character of the involvement is the prominent change. It is possible that these patients suffered from a decrease in plasma protein from inanition as a result of vomiting, diarrhea, and anorexia. The lowered colloid osmotic pressure plus damage to the capillary endothelium from severely anemic blood could have led to the serous exudation observed. The direct effects of radiation may have played a role, but characteristic radiational damage was not detected histologically.

Choroid. A severe serous detachment is commonly the result of considerable reduction in the intraocular pressure. There is no such information in Case 10 although the fibrin and bacilli in the anterior chamber may have resulted from perforation.

Septic choroiditis which consists of

loose accumulations of mononuclear wandering cells in the stroma of the choroid from septicemias of various types,¹⁴ was found in the first three cases of this report. Although bacteria were not found in the tissues, the possibility of their presence in the eye is good, in view of the bacterial invasion in two other cases.

No choroiditis was observed clinically but this is to be expected from the mild character of the involvement.

The striking distention of the vessels of the entire eye by white cells in Case 15 is most pronounced in the choroid. These cells are mainly mononuclears and do not appear immature. I can find no theory to explain adequately this unusual reaction. The number of white cells is greater and the number of red cells less than could be explained by the manipulation upon removal. Although a regenerative process which overshoots its mark after roentgen irradiation may give rise to an increase in mononuclears,¹⁵ such an excessive regeneration seems unlikely in view of the lack of a leukocytosis in other patients, and in view of the fact that the leukocyte count would have had to have been in the hundreds of thousands. Leukemia has occurred after radiation,¹⁵ but these cells do not appear leukemic.

Optic nerve. No important changes in the optic nerve were observed either clinically² or pathologically.

Retina. Flick² found the retinal vessels to be normal and this is true in these sections.

The eyes in this series were obtained at autopsy, and eyes so obtained will show autolysis of the retina. The generalized atrophy in Case 15 may have been due to postmortem autolysis or to a local anoxemia caused by the white cells crowding out the red cells plus a stasis of circulation.

Clinically, edema of the retina was common² but definite evidence is lacking histologically. Exudates were common. They

were round, snow-white, slightly elevated, and obscured the retinal vessels when lying over them.² It is possible that they were nodules of leukocytes such as is shown in Figure 4. This nodule bulges up the internal limiting membrane and could be correlated with the elevated appearance seen clinically. The feathery edges might have been due to the presence of cells at the periphery of the nodule where they would be thinned out and separated by nerve fibers. Also the round character of these spots correlates well. There are more probable causes of such exudates, but no other plausible explanation is apparent from a study of the tissues available.

Some of the exudates seen by Flick were elongated and often of a peculiar zig-zag formation in which the extension in length was perpendicular to the direction of the nerve fibers.² It is possible that these peculiarly shaped figures were due to heavy masses of fibrin next to the external limiting membrane. This could explain their character of running cross grain to the nerve fiber bundles.

There is no evidence of the retinal hemorrhages seen clinically.

BACILLI

The patient in Case 27 was the one with the remarkable invasion of the eye by streptobacilli. This person was found to have an ulcer of the leg and an ulcer of the rectum on postmortem examination. The gastrointestinal tract is most sensitive to radiation,¹⁶ and complaints referring to it were almost universal. Burns and cuts were also common. It is possible, therefore, that bacteria made their entrance through one or more of these portals and disseminated throughout the body just before death. The lack of leukocytic response to their presence supports the assumption of a terminal bacteremia. It is postulated that these bacilli remained

in the tissues where they grew and hastened the process of postmortem autolysis until stopped by the fixing agent.

THE ATOMIC-BOMB RADIATION

According to Larkin,⁹ the disintegrating products of plutonium fission consist of fission fragments, neutrons, and beta particles, and a transformation of the remainder into heat, gamma rays, and radiant energy which includes ultraviolet, visible, and infrared radiation. Since these products produce similar reactions in the body, it is difficult to say with certainty what part each of these products played.

The radiation sickness seemed to be similar to that usually seen with heavy total-body irradiation.⁹ Its principal effect was on the bone marrow resulting in aplastic anemia.¹⁷ The average patient complained of fever, malaise, loss of appetite, bleeding gums, and hemorrhagic diarrhea.¹⁶

By a process of calculation, Larkin concluded that there were 473r/sq. cm. at 1,250 meters from the point where the bomb was dropped.⁹ Irradiation of the entire body with 500r will kill.¹⁸

Except for changes in the cornea and lens, no definite evidence of direct damage by radiation was observed. It is probable that the Japanese who received severe whole-body irradiation died before any severe local manifestations could be observed.

There are certain histopathologic features of the effects of radiant energy on general body tissues which, when taken in combination, are characteristic. These are the presence of giant and irregular nuclei, the presence of hyaline connective tissue, and the presence of thick-walled hyalinized blood vessels.¹⁸

None of these features was seen.

SUMMARY

Sections of eyes of patients who had

died from the effects of the Nagasaki atomic-bomb irradiation one month after the bombing were studied. The histologic changes may be grouped into those apparently due to direct irradiation and those due to the systemic condition.

The cornea and lens may have been damaged by direct irradiation. Some of the corneas are found to be denuded with evidence of epithelial regeneration. The lenses may be in the early stages of developing radiational cataracts as evinced by small vacuoles in the superficial cor-

tex and a thickening of the posterior capsule.

The following changes were due apparently to the patient's systemic condition: (1) serous exudation into and from the ciliary body; (2) invasion of the eye by bacilli; (3) septic choroiditis; (4) nodular cellular infiltration of the retina; (5) fibrin nets on the surface of the retina; (6) and, in one case, a striking distention of all the ocular vessels by white cells, most of which were mononuclears.

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CORNEAL LESIONS IN HODGKIN'S DISEASE

REPORT OF A CASE*

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All that is known of the histology and clinical appearance of the malignant lymphogranulomas combines to define it as a disease of unknown etiology, characterized histologically by an inflammatory process of the prevalent productive type affecting essentially the reticulo-endothelial tissue, evincing a predilection for that of the lymph glands, and leading to the formation of a specific granular tissue (Cionini).

Although there is the possibility of its involving any and every organ and tissue in the body, Hodgkin's disease shows a conspicuous predilection for those structures wherein the reticulo-endothelial system is chiefly represented; hence, the lymph and hemopoietic organs are most frequently involved. Nevertheless, the process does not affect the parenchyma of these organs directly, but only the stroma, as is true also of all organs and tissues that are included in the lymphohemopoietic system.

Thus, Sternberg's cells can readily be found in the lymph glands, the spleen, and the bone marrow; in the liver, mediastinum, and lung, and, with varying frequency, everywhere in the gastro-intestinal tract, as well as in the small and medium intraparenchymal blood vessels.

They are found somewhat less frequently in the skeletal system, the pericardium, pleura, skin (specific lesions), and in some of the endocrine glands (thyroid, adrenals, pancreas).

Foci are seldom situated in the muscular system, the uropoietic and genital ap-

paratus, in the thymus, and the nervous system.

Granulomatous changes involving the heart and large blood vessels, the mucous membrane of the mouth, pharynx, tonsils, esophagus, and rectum are rarely found. In exceptional instances, a granulomatous nidus has been observed to occur in the hypophysis (Graf, Cacciamali).

As to the visual apparatus, direct lesions have been infrequently reported as occurring in the orbit, the lacrimal gland, and the eyelids (Mueller, Ridley, Dutoit, Hoeckel, Colrat), the conjunctiva (Dellille, Cocchi), the fundus (Hegner, Heine, Kyrieleis, Sachs, Bell, Mariotti), and the cornea (Sachs, Morax, Lagrange).

The rarity of ocular involvement in Hodgkin's disease may be due to the scarcity or absence of the reticulo-endothelial system in the various structures of the eye. In effect, it is entirely absent in the vitreous, lens, and aqueous humor but occurs abundantly in the choroid and, to a somewhat less degree, in the pigment layer of the iris. The sclera has scarcely any, and this is also true of the retina in spite of the vascularity of the latter, whose cells contain none whatever. Recently, Gasteiger and Ciotola, although they have not established the existence of reticulo-endothelial elements in the cornea, have found in keratitis certain cellular elements that have taken the supravital stain and were, therefore, considered as belonging to the reticulo-histiocyte system.

In view of the infrequency of ocular complications in Hodgkin's disease, the following occurrence of such an involve-

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ment is described from the case histories of the Ophthalmological Clinic of the University of Rome, through the kindness of Professor Cavara, its director.

CASE REPORT

History. T. A., a housekeeper, aged 27 years, gave no history of parents and relatives, but mentioned that she had had typhoid fever at the age of 11 years; that thereafter she had been in good health; and that she had married a man apparently of sound health and had had several sons.

In the spring of 1939, she had not been so well, had had a little fever, and noticed a tumefaction of the glands of the neck. The physician diagnosed the condition an anemia and gave her treatment. Some months later, physicians in Perugia made a biomicroscopic examination of the cervical lymph glands and advised her to have X-ray treatments. These gave much relief. Later, she went to Rome where, for about a year, she was well.

Early in 1942, while her health was again failing, she noticed a tumefaction of a gland on the left side of the neck. She was given a thorough physical examination by a physician, including: X-ray study of the chest and Wassermann, tuberculin, and morphologic blood tests. As a result, she was advised to take a second series of X-ray treatments, which again cleared the condition, generally and locally. Before long, however, a new growth appeared, this time in the right axillary region. This again was successfully treated, but later a growth appeared in the left axilla, accompanied by itching and irregularity of the menses.

In February, 1943, the patient first had trouble with her eyes: photophobia, lacrimation, and diminished vision of the right eye. In June, on Professor Cavara's advice, she entered the Clinic.

Ocular examination. The cornea of the

right eye presented a superficial zone of infiltration with irregular, somewhat wavy edges. There was partial loss of the epithelium and marked hypoaesthesia. The iris was somewhat congested. The left eye, near the lower limbus, had two smaller zones of opacity with the same characteristics as those of the right eye. From the lower opacity, a line of superficial infiltration branched off toward the corneal center. There was evident hypoaesthesia. The iris was considerably congested, with marked pericorneal injection.

In general, the keratitis, although not presenting well-defined characteristics, had a herpetiform appearance. Experimental test on a rabbit's cornea, however, was negative.

After more than a month of treatment—iodine, atropine, dionine, urotropine, and endovain—the patient was dismissed because of the air raids. Her condition had improved a little; in fact, the cornea of the right eye showed a dissipation of the superficial infiltration; the ciliary reaction was still present. In the left eye, the cornea was opaque in the lower peripheral sector, especially deep in the stratum, the infiltrative process having, in the meantime, reached the parenchymal strata. Descemet's membrane was not wrinkled.

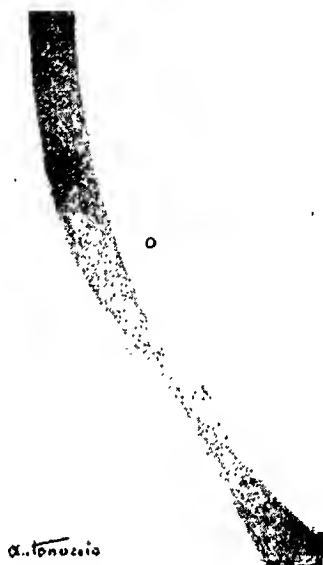
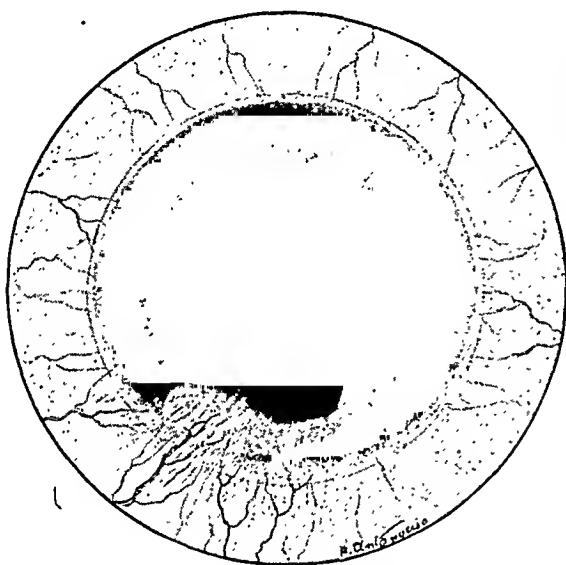
In September of 1943, after another series of X-ray treatments to the lymph glands, the patient was remarkably improved, even as to the eyes, and for a few months required no special treatment. The general and local conditions remained almost stationary until February, 1944, when the patient again came to the Clinic. Professor Cavara noticed a new congestion of the left eye. He thought the patient should be given a general examination and the blood picture defined morphologically. She, therefore, came to the Clinic of the University of Rome. The medical examination confirmed the

diagnosis of Hodgkin-Sternberg disease.

The blood picture was as follows: Hb., 56 percent; R.B.C., 4,000,000; C.I., 70; W.B.C., 14,000, of which polymorphonuclears comprised 80 percent; endothelialocytes, 10 percent; lymphocytes, 10 percent. The red blood cells showed little, if any, poikilocytosis.

Further ocular findings. Right eye. The adnexa were normal. There was a slight

terior surface of the cornea was seen to be slightly irregular and strewn with small, pointed, gray spots with irregular edges, some confluent, some arranged in thin, wavy lineal streaks. Tested with fluorescein, many of these spots took on color. In places, the corneal parenchyma appeared to be normal; in the more opaque zones, a light infiltration of the most anterior strata of the parenchyma



Figs. 1 and 2 (Matteucci). Fig. 1, Drawing of the left eye. Corneal thickness is reduced, and infiltration is so dense as to give the appearance of a well-developed lesion. Thin, aborescent vessels from the limbus are advancing into the cornea.

Fig. 2, With the slitlamp beam well-narrowed, the posterior surface of the cornea is seen to be irregular and somewhat prominent toward the anterior chamber.

pericorneal injection. By oblique illumination, a zone of slight turbidity was observed. It had irregular edges and included the left lower portion of the pupillary space and the lower part of the cornea. The turbidity was not homogeneous but in places was intense, elsewhere less so. Some of the turbid zones had a dislike aspect with blurred edges, 3 to 4 mm. in size. In the opaque zone of the cornea, the surface was not lustrous and smooth but appeared roughened; this was confirmed by examination with the biomicroscope.

By means of this instrument, the an-

terior surface of the cornea was seen to be slightly irregular and strewn with small, pointed, gray spots with irregular edges, some confluent, some arranged in thin, wavy lineal streaks. Tested with fluorescein, many of these spots took on color. In places, the corneal parenchyma appeared to be normal; in the more opaque zones, a light infiltration of the most anterior strata of the parenchyma

was observable. This could best be viewed by means of a very slender pencil of light. In addition to these zones of corneal infiltration, which were thought to be actual lesions, granular in appearance and having blurred edges, there were others with more sharply defined borders, probably the result of the older lesions observed in July, 1943. There was evident hypoaesthesia. The iris was slightly hyperemic. The pupils were round and reacted promptly to light and accommodation. Lens, vitreous, and the fundi were normal. Corrected vision, with a -1D.

cyl. ax. 80° was 6/10. The ocular tension was normal.

Left eye (figs. 1 and 2). The adnexa were normal. There were slight photophobia and pericorneal injection. Upon examining the cornea with focal illumination, a wide zone of corneal opacity was observed, affecting the central and lower portions. In this eye, also, the opacity was not homogeneous but varied in intensity. This was especially observable at two points: (a) in the peripheral part, where there was a zone of denser opacity, semilunar in form, parallel to the limbus, 6 to 7 mm. long, about 2 mm. wide, and at 2 to 3 mm. distance from the limbus; (b) in the central part was another, more densely opacified, round portion, 1 mm. in diameter. The surface of the cornea over this lesion was irregular, as described with respect to the right eye.

Upon slitlamp examination, the corneal parenchyma of the left eye was seen to be much more involved than that of the right eye. Indeed; whereas, in the right eye there were zones where the epithelium was affected and some where the infiltration of the parenchyma was sharply limited to the immediate subepithelial stratum, in the left eye, the turbidity affected the parenchyma throughout its entire thickness.

In the left eye, the following changes were observed: the corneal thickness was reduced, the infiltration being so dense as to give the appearance of a lesion well advanced, if not entirely developed. This infiltration was especially marked in the deeper strata. With the beam well narrowed, the posterior surface of the cornea was seen to be irregular and somewhat prominent toward the anterior chamber. Thin, arborescent vessels from the limbus advanced into the cornea, some superficially, others more deeply. On the posterior surface of the cornea in the (a) zone, and exactly corresponding to its thin

part, three or four masses of flattened and amorphous pigment could be seen. In the (b) zone, the infiltration seemed to be of an entirely recent process and more marked in the layers straddling Descemet's membrane, but it differed from (a) in that the thickness of the cornea was normal. Here there were no newly-formed vessels. The cornea was hypoes-thetic. The anterior chamber was normal as to depth; the aqueous clear. The iris was slightly hyperemic; the pupil round, and its reactions normal. The posterior segment was normal. The corrected vision, with a $-75D.$ cyl. ax. 90° , was 4/10.

The patient was seen occasionally during the following months, but the corneal lesions showed only slight alterations during this time. The evolution of the lesions was somewhat slow; the clinical aspect changed but little. Both eyes were slightly photophobic. Fluorescein staining of the epithelium, in the right eye especially, had almost disappeared, but the gray spots were still observable; evincing a greater tendency to confluence, to form thin, irregular streaks in large curves. The deep infiltration especially in the left eye, was reduced in intensity. On the patient's last visit, the epithelial streaks had assumed a dendritic aspect, resembling the dendritic keratitis of herpes. The parenchymal lesions were slowly improving.

DISCUSSION

From what we know of the literature, only one case of Hodgkin's disease has been reported showing corneal changes of the type just described; namely, the case reported by Sachs, which in many of its features is similar to the one I have observed. Lagrange's and Morax's cases differ basically because of the morphologic characteristics of the corneal lesion.

Sachs gives a good description of a

bilateral keratitis of long standing in a patient with malignant lymphogranuloma. The corneal involvement was characterized at the beginning by superficial marginal infiltration, erosions, and small gray spots of a herpetic type, but without corneal hypoesthesia. Subsequently, this writer observed the formation of a deep ulceration followed by a keratitis of dendritic type and, at last, a superficial vascularization. The ocular condition, followed over a period of many years by this author, suffered alternatives of remissions and exacerbations, and seemed to be much improved by treatment of the glandular affection with the X ray.

Lagrange speaks of an interstitial annular infiltration of the cornea with successive thrusts into the depth and of the coexistence of a limbic, deep vascularization radially disposed, similar to the one presented by inherited syphilitic interstitial keratitis; even in this case, lesions seemed to improve with X-ray application. Morax, lastly, in a patient in whom lymphogranuloma could not be definitely diagnosed because of the many lacunae of the general examination, found a circumscribed episcleritis that eventuated in parenchymal infiltration of the cornea.

Regarding the clinical case just described, it is important to note, from the general point of view, the rising, the regression, and the duration of the glandular tumefactions; the clinical response, the absence of reactions to tuberculin, the negative Wassermann reaction, the morphologic blood picture, the influence of X ray on the glandular tumefactions and on the general condition of the patient. All these observations point to a diagnosis of Hodgkin's disease.

As to the nature of the keratitis found in this patient, it is important to note that the polymorphic aspect of the corneal lesions, the renewed exacerbations, and the long course were reminiscent of the many

aspects of herpetic keratitis. This herpetic form aspect was much more evident in Sach's cases. Nor is there any contradiction in the fact that in our patient's left eye there was a deep infiltration also, for it is well-known that, among the cases presenting typical corneal lesions of the dendritic type, no morphologic aspect is pathognomonic of corneal herpes.

One need only consider superficial punctate keratitis and disciform keratitis, forms not at all resembling the classical aspect of corneal herpes and actually representing syndromes in which a herpetic etiology occupies an important place (Cavara).

Cavara and others have also demonstrated that herpetic virus can produce parenchymal infiltration of the cornea not of the disciform type. In the present case, however, it must be remembered that the biologic test of the rabbit's cornea was absolutely negative, and it is not known that the patient was ever subject to herpetic eruptions on lips and face. A syphilitic cause cannot be the basis of this keratitis because the clinical aspect was entirely different and the frequent serologic blood examinations were always negative. On the other hand, the bilaterality of the affection, the lack of reaction to tuberculin, and the absence, or nearly so, of corneal vascularity indicate that the disease is not tubercular in nature.

It is not possible that the corneal lesions in this case would be due to any of the widely known agents capable of producing keratitis, and not a single such proof has come out of the few cases described by the preceding investigators.

At this point, it might be well to recall the frequent association, noted by many writers, of Hodgkin's disease with herpes zoster. In the histories of malignant lymphogranulomas, herpes zoster is very often present during the illness; similar cases have been observed by many writers

(Vattuone, Burnam, Weismann, Netter, Schreus, Middleton, Goldman). The first to call attention to the appearance of zoster during Hodgkin's disease were Pancoast and Pendergrass, who observed four cases; following these were Baldrige and Awe, with 6 cases in 46 of lymphogranuloma; Craver and Cushman, 3 cases in 72; Porta, 4 in 50. This recorded incidence would lead one to think that the appearance of herpes zoster during Hodgkin's disease is not a casual coincidence. Many pathogenetic hypotheses have been drawn up on the basis of this record. Some of these admit the existence in lymphogranuloma of anatomic alterations of the spinal ganglia or posterior roots favoring the culture of the unidentified zosterian virus. Another hypothesis maintains that lymphogranuloma represents a condition conducive to the thriving of the zosterian virus on spinal ganglia, independent of the presence or absence of resultant lesions. In view of the fact that up to this time no demonstration of an anatomic lesion of ganglia has been made, a hypothesis less susceptible to criticism and one most widely accepted seems to be to consider lymphogranuloma as a morbid condition which particularly favors the thriving of zosterian virus on spinal ganglia, independently of lesions of any nature in the ganglia themselves (Cionini). Nevertheless, the keratitis observed in our case and in those previously described as in association with Hodgkin's disease did not have the characteristics of a zosterian keratitis. The latter is more typical of keratitides, due to a virus of herpes febrilis, nor have there ever been eruptions of herpes zoster on the skin.

It is, therefore, possible that the ocular affection of our patient can have an etiologic connection with the primary disease; that is, malignant lymphogranuloma. Among the facts that focus the attention

on such a possibility, the most important are the rising of corneal lesions during Hodgkin's disease and their remarkable amelioration as the result of irradiation of the lymph glands.

As to the cause of malignant lymphogranuloma, it is well-known that, whereas today those who advocate a tubercular etiology are becoming fewer, the infective nature of the affection is gaining more and more acceptance. A group of researches, begun in 1933 by Gordon, on the cause of lymphogranuloma has revealed biologic phenomena deserving of the most careful consideration, even if they could not effect a conclusive solution of the problem. According to these writers, the lymph glands affected by Hodgkin's disease contain an active principle (virus or ultravirus) capable of determining a meningo-encephalitic picture if injected endocerebrally into a rabbit. According to other writers, this substance could be a necrocytotoxin with a particular liking for the cerebral substance of rabbit and cavia; and, according to still other writers, a substance of an enzymelike nature, very similar to that extracted from leukocytes, bone marrow, and spleen of subjects not affected by malignant lymphogranuloma.

Recent data on the etiologic agent of inguinal lymphogranuloma allow its classification in the group of ultraviruses, according to Magrassi. Researches on the causal agent of malignant lymphogranuloma introduce an element suggestive of an analogy with this group of infectious agents and, day by day, this analogy is growing in importance and extent. Researches up to now have not clearly demonstrated a virus to be the etiologic agent of malignant lymphogranuloma, but the hypothesis has a great deal of probability.

In this hypothesis, there is nothing contradictory in the admission that the keratitis observed in Hodgkin's disease is due,

etiologically, to the virus of the primary disease that would be capable, together with a number of other viruses (fever herpes, zoster, epidemic parotitis), of causing corneal lesions more or less characteristic.

CONCLUSIONS

Of the many reasons mentioned for presenting this account of a herpetic type of keratitis appearing in the course of Hodgkin's disease, the following are the most important.

1. The rarity of the occurrence as reported in the literature.

2. The effect of general radium therapy on the course of the ocular lesion that would confirm the radium sensitivity of specific cells of malignant lymphogranuloma.

3. Probable etiologic association that seemed to exist between the supposed virus of lymphogranuloma and the corneal lesions described.

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THE MARCUS GUNN PHENOMENON

DISCUSSION, PRESENTATION OF FOUR INSTANCES AND CONSIDERATION OF ITS SURGICAL CORRECTION*

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The Marcus Gunn phenomenon, that is, congenital ptosis with an associated jaw-winking reflex, is not an uncommon finding. In two series of consecutive cases of congenital ptosis, it was present in 2 percent of the first 100 cases seen; and in the next 50 cases seen, 2 additional instances appeared. It therefore has an approximate incidence of 2 percent of all cases of congenital ptosis. The symptom complex is essentially an intermingling or misdirection of developing fifth-cranial-nerve fibers, and perhaps tracts, and the oculomotor-nerve fibers. All degrees of the condition are frequently seen, some so slight in amount that they are overlooked. The only cases which come to the attention of the ophthalmologist or of the neurologist are those with ptosis of such a marked degree that relief is sought for the ptosis.

According to Bing and Haymaker,¹ the Marcus Gunn phenomenon occurs not only in cases of congenital ptosis, but also in individuals with acquired ptosis and in some, as was just stated, who are free of ptosis. The term "Marcus Gunn phenomenon" should be applied only to the congenital cases. The term "pseudo-Graefe syndrome" has long been connected with and considered as the proper term for this condition when acquired, involving as it usually does, the levator and resulting from the misdirection of regenerating third-nerve fibers.

The basic premise of this presentation

is a discussion of the Marcus Gunn phenomenon. The consideration of the acquired form of pathologic associated reflexes, as seen with the pseudo-Graefe syndrome, will be of assistance in helping to understand the basic subject. Some other pathologic associated reflexes seen, and relevant, are the contraction of the orbicularis associated with movements of the jaw; the contraction of the levator with adduction or abduction of the eyeball; the rather unpleasant contraction of various facial muscles which one sees after an acquired facial paralysis; and the syndrome of "crocodile tears" with and after a facial paralysis.

There is but little doubt that the pseudo-Graefe syndrome is a frank peripheral misdirection of regenerating third-nerve fibers. Figure 1² shows such a situation wherein, as the result of a fracture at the base of the skull, a complete third-nerve palsy developed. Some time later, when maximum spontaneous recovery had ceased, the patient presented a paralysis of left upper rotation; paresis of left internal rotation; a dilated pupil; a variable ptosis; and downward rotation was limited to some degree. The ptotic lid lifted strongly with downward or internal rotation; also with downward rotation, the fixed dilated pupil contracted almost to the normal. In the process of regeneration of the third-nerve fibers, certain fibers destined for the inferior and the internal rectus muscles had found their way from the point of sectioning into the neural sheath of fibers normally bound for the levator. Also fibers normally destined for the inferior rectus terminated in the sphincter iridis.

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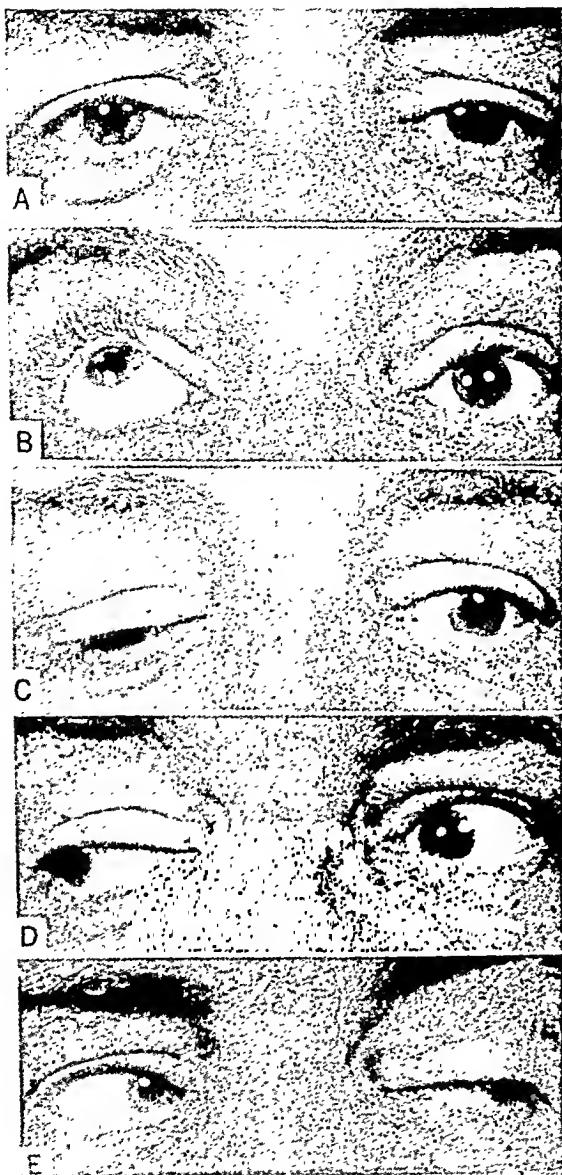


Fig. 1 (Spaeth). Pseudo-Graefe syndrome. (Spaeth, E. B. *Ophthalmic Surgery*. Philadelphia, Lea and Febiger.). Paralysis of superior rectus, paresis of internal rectus, paresis of inferior rectus, associated elevation of levator with downward and internal rotations C and D. Complete ptosis with left lateral rotation. Contraction of pupil can be seen in C.

In an instance such as this, there must have been some type of break in the continuity of the fibers as they lay within the trunk of the third nerve. This must have occurred at some place before the third nerve divided into its two major divisions, in all probability intracranially, but certainly after the emergence of the

trunk of the nerve from the brain stem. A complete third-nerve paralysis unilateral, involving both the intrinsic as well as the extrinsic muscles of the eye, without any contralateral pareses whatsoever, has, perhaps, as the most common etiology, a vascular situation either connected with the Circle of Willis, or with the posterior cerebral artery. Because of that, some too much regeneration (no matter how complete this may be) is always a possibility. During that process of regeneration, some twisting can occur to the trunk of the nerve from small bands of organized cicatricial tissues resulting from the trauma and causing the misdirection of the fibers within the trunk itself.

According to Helfreich and Bernhard,³ the Marcus Gunn phenomenon can be explained only on the basis of neuronal intercommunications between the nuclei of the facial, trigeminal, and oculomotor nerves, or as a result of a cortical or subcortical (Bing¹) pattern analogous with the Bell's phenomenon. Such an intercommunication has more recently been denied by Lewy, Grant, and Groff.⁴ Obviously neither a cortical ocular reflex arc nor an intranuclear connection of the oculomotor nerves could be affected by an extramedullary sectioning of the fifth nerve to the pterygoids. These investigators (Lewy, Grant and Groff) state that the Marcus Gunn phenomenon is completely abolished by sectioning the motor root of the trigeminal nerve, but that with forcible movements of the jaw, postoperatively, the associated movements of the eyelid could still be elicited. This suggested to them the presence of a proprioceptive arc, the afferent limb of which (at least in part) was the sensory portion of the mandibular division of the trigeminal nerve. They assumed that the efferent part of the arc, that which passed to the eyelids, was via autonomic fibers whose path-

way was undetermined, but thought to be via the ophthalmic division of the trigeminal nerve. There is no controversy as to the afferent pathway, but there seems to be some logical doubt relative to the efferent portion of the arc. The question cannot be answered with entire satisfaction without considering the possibility of some brain stem, intramedullary infranuclear communication, as originally suggested by Helfreich and Bernhard.

The observation of Lewy, Grant, and Groff can be answered in part, perhaps, upon the basis of Cannon's law of denervation. This states, according to Walsh,⁵ that postganglionic, and to a lesser degree preganglionic, sectioning of a nerve results in increased sensitivity of the innervated structure to chemical modification, whether or not that substance be sympathin or acetylcholine. The sensitivity persists providing that regeneration does not occur, and that the innervated structure does not become atrophic. Hence it would be unnecessary to assume the proprioceptive reflex arc, with the efferent portion they outlined as still intact, as a reason for the condition.

Lewy, Groff, and Grant did a great amount of experimental work on cats; first, however, sectioning the oculomotor nerve. These studies included the effects of acetylcholine, of nicotine, of epinephrine, and of atropine, the effects of faradic stimulation upon the peripheral stump of the previously sectioned nerve, upon the gasserian ganglion and its three divisions under varying circumstances, and the effects of chemical and electrical stimulation of the cervical portion of the sympathetic trunk; all these as they reacted after the third nerve had been cut for at least 12 days.

Two cu. mm. of acetylcholine were injected into the right carotid artery. This injection was finished in 15 seconds, but an enlargement of the palpebral fissure

continued for an additional 10 seconds. This portion of their study, therefore, is a confirmation of Cannon's law of denervation and has nothing to do with possible intraneural connections. The other findings were not as conclusive, however. In its three phases of widening of the right palpebral fissure were shown subsequent to faradic stimulation of the peripheral stump of the sectioned first division of the fifth nerve. The right oculomotor nerve had been divided 16 days before this experiment. There was a return to the original position of the lids 25 seconds later. Electric stimulation of the peripheral stump of the previously sectioned third nerve, regardless of the strength of the current, failed to produce any reaction whatsoever whether 7 or 42 days after sectioning of the third nerve.

Electric stimulation of the gasserian ganglion with the root and its branches intact produced slight widening of the ipsilateral fissure, also after sectioning of the second and third division, but after sectioning of the first division stimulation of the ganglion became ineffective. Stimulation of the stump of the first division produced the phenomenon, but stimulation of the stumps of the second and third divisions did not. Insofar as this part of their study is concerned, there is some definite connection between a muscle controlling the width of the palpebral fissure and the first division of the fifth nerve, but whether it is sympathetic or somatic cannot be answered on these findings. Sympathetic stimulation can widen the palpebral fissure appreciably and quite readily in the presence of a completely paralyzed levator, as has been demonstrated experimentally as well as clinically. It seems that the observations of Lewy, Grant, and Groff in this part of their study could be explained on the basis of pure sympathetic stimulation. An intraneural connection between the fifth nerve

proper, the gasserian ganglion, and/or the somatic nerve to the levator is not necessary.

Further experimental work of theirs on the sympathetic nervous system was carried out, but this did not help to clear up anything. In some of their animals, simultaneously with the division of the oculomotor nerve, the ipsilateral cervical portion of the sympathetic trunk was resected for about one centimeter below the superior cervical ganglion. Subsequent injections of acetylcholine and atropine enlarged the palpebral fissure and the pupil as it did before cutting the cervical portion of the sympathetic trunk. Intravenous injection of from 5 to 10 mm. of ergotoxine increased the elevation of the upper lid, but no further dilatation of the palpebral fissure could be obtained by subsequent electrical stimulation of the gasserian ganglion or of the first division of the trigeminal nerve.

It seems possible, therefore, that in the first part of this study Cannon's law of denervation may be effective. In the second part, the same is probable, although more likely the effect is by way of the cervical sympathetic and the effects of stimulation to the sympathetic nervous-system supply for the unstriated muscles of the lid (Müller's orbito-palpebral muscle). The observations of Lewy, Grant, and Groff are undoubtedly correct and valuable. Their interpretation, however, is for the moment open to controversy, since it does not prove that the efferent pathway of the Marcus Gunn phenomenon is by way of the first division of the fifth nerve. One cannot be too certain of the role that this unstriated muscle of the upper lid may play. It might even be a major role in an associated reflex responsible for the Marcus Gunn phenomenon.

One wonders why the efferent portion of the arc of this Marcus Gunn syndrome

cannot be caused by congenital misdirection of developing peripheral (infranuclear) nerve fibers; the source of the fibers arising properly in the proper nuclei, the faulty distribution, however, occurring in the posterior longitudinal bundle or even more peripherally within the brain stem, excluding wholly any relationship to the autonomic system. The efferent pathway would then be by way of the superior branch of the third cranial nerve. This seems plausible when one considers the many vagaries of the pseudo-Graefe syndrome; as, for instance, the oddity of fibers destined for the inferior rectus terminating in the sphincter pupili. The sphincter pupili is certainly not a striped muscle. In the case presented, the fibers originally destined for the inferior rectus muscle formed subsequently the innervation of such a histologic type muscle.

The syndrome must have motor fibers as the efferent portion of the arc. The afferent portion of the arc may be purely proprioceptive, and it may arise even in connection with the higher cerebral centers. Similar higher cerebral center controlled phenomena are not uncommon. A feeble-minded individual examined recently developed a strong elevation of both upper lids through an emotional stimulation when chided, and Walsh⁵ has a patient in whom the lid elevated invariably whenever he lost his temper or became interested in an attractive member of the opposite sex. This certainly could be sympathetic in origin and not somatic in origin. One might, under such circumstances, consider the cortex as the point from which the synchronous action of this phenomena can be initiated.

Bender, however, as discussed by Walsh,⁵ had an experimental animal in which he obtained an elevation of the upper lid by producing rage in the animal, and this after sectioning of the third nerve. Bender concluded that it was sen-

sitivity to acetylcholine and not a sympathetic reaction. Cannon agreed with Walsh that Bender was probably correct as regards the elevation of the lid but that it was not proved completely. Upon this possibility, Walsh thought that the elevation of both lids, which occurred in his patient through emotional stimulation, was also the result of acetylcholine and not from sympathetic stimulation. Either might be the factor and this also might be proved experimentally.

Relative to this, two instances of a reverse jaw-winking associated reflex have been mentioned in the literature, one by Amat,⁶ and one by Benoit.⁷

The close proximity in the cerebral cortex of centers for the jaw and the eyelid is well-known. Adler⁸ suggested this as a possibility. Another consideration on this same basis is that of Wilson⁹ who spoke of such associated movements as an association of movements and not of muscles. We know, however, that in the Marcus Gunn phenomenon¹⁰ we are dealing only with a single muscle in the eyelid, and the experimental studies of Lewy, Grant, and Groff eliminate Wilson's and Adler's conjectures.

Embryologically the relationship between the motor nuclei of the fifth nerve and the nucleus of the oculomotor is rather close. The sensory root of the fifth nerve, which might constitute the afferent portion of the arc, arises separately from the motor root, and is a derivative, at least in part, of the ganglion crest. The motor root appears later than the sensory root and is derived from a mass of neuroblasts lying in close relationship to the developing oculomotor and trochlear nuclei in the floor of the mesencephalon. The neuroblasts, as they develop for both nuclei, third and fifth, belong to the lateral column. The motor root of the trigeminal nerve appears definitely later than does the sensory root. The ganglion itself has a

rather complex formation in that it is the fusion of proganglia and pronerves, several of each, into a complex mass. One can see, therefore, that it would be rather difficult, embryologically, for the development of intermingled sensory and motor fibers, as would be necessary if the first division of the gasserian ganglion was wholly the efferent portion of the arc. If, however, the entire reflex arc was a motor complex arising in the third division of the trigeminal, from thence to the gasserian ganglion, thereafter to the third-nerve nucleus by embryonal, intraneural connections (hence still motor) with the oculomotor nucleus and the pathologic efferent portion of the arc as a part of the oculomotor nerve, we see that it is embryologically and developmentally possible. These may not be conclusive ontogenetic explanations but they must be considered. Another possibility, mentioned above, is that the afferent pathway is sensory, but that in the gasserian ganglion the afferent pathway begins as motor, from there pathologically to the oculomotor nucleus and thence out by way of the third nerve to the levator. This seems to be suggested rather definitely in the first of the cases herein presented. In that case, as will be described, the levator palpebri superioris was the only muscle normally present and bilaterally so. All other ocular muscles and oculomotor nerves were absent. There was certainly a break in neural development of some type here, extraordinary in its character.

These pathologic associated reflexes, congenital or acquired, need not of necessity be a combination of proprioceptive afferent and motor efferent. As interesting is the sensory afferent and sympathetic efferent reflex arc which one sees in crocodile tears. This syndrome of crocodile tears, commonly considered as connected with facial paralysis alone, is actually not unlike the true Marcus Gunn

phenomenon except that the afferent and efferent pathways are a combination of sympathetic fibers (taste fibers), fifth-nerve fibers, and seventh-nerve fibers. The statement that this syndrome of crocodile tears is similar to the Marcus Gunn phenomenon is based upon the presentation of Lutman's¹¹ case in which he described two cases of facial asymmetry wherein a third-division, fifth-nerve, sensory stimulation resulted in a first division, sensory, response with lacrimation. In his cases the patients had (unilateral in one and bilateral in the other) congenital paralyses of the sixth nerve. This matter of crocodile tears as a pathologic associated reflex may be considered upon the following basis. Centripetally the taste fibers from the anterior two thirds of the tongue enter the facial nerve by way of the chorda tympani. From here the total possibilities are: (1) facial nerve fibers into the geniculate ganglion; (2) a new taste fiber into and through the superior (greater) superficial petrosal nerve; (3) sphenopalatine ganglion; (4) maxillary division of the fifth nerve and the gasserian ganglion; (5) nucleus solitarius of the medulla.

Lutman also thought that one had to consider seriously in his cases an intramedullary pathologic relationship between the sixth-nerve nucleus and the genu of the seventh nerve.

The suggestion had been made that this pathologic reflex, in its association, had misdirection of fibers in the sphenopalatine ganglion where they synapse about those cells whose axons go by way of the zygomatico-temporal nerve to connect with the lacrimal gland. This reflex arc does not need an intranuclear pathologically associated reflex according to the above opinion which first arose probably with Ford,¹² but it is possible.

Grant¹³ has made some very pertinent and important remarks relative to the

Marcus Gunn reflex. He asked the question: "Is there a nuclear connection in the brain stem?" And he answered the question as follows: "This was the opinion put forward by the commission that examined the patient in Gunn's original case." He himself (Grant) was unwilling to accept this answer.

Nuclear connections between the cranial nerves exist in the brain stem as exemplified by Bell's phenomenon, recently analyzed by Slotopolsky.¹⁴ The work of Mendel¹⁵ and Tooth and Turner¹⁶ and the clinical observations of Hughlings Jackson¹⁷ suggest a nuclear connection between the facial and oculomotor nerve; however, Harman¹⁸ vehemently denied, on morphologic and embryologic grounds, the possibility of any such internuclear connection, since they are of different orders of nuclei. Villard,¹⁹ Pontico,²⁰ and Amat⁶ discussed the possibility that the associated movements may in some way be mediated through the posterior longitudinal bundle. Lastly, the suggestion has been made that there may be peripheral connections between the branches of the third and those of the fifth nerve, although, as Pontico stated, detailed anatomic studies have failed to produce convincing evidence of this.

Walsh²¹ in a personal communication to me stated rather pertinently that this matter of congenital misdirection of developing fibers would have to be most seriously considered if a case would be found with seventh-nerve involvement present with the jaw-winking reflex. Case 3, to be presented, suggests an interesting possibility of congenital misdirection of fibers because the sixth nerve enters into the complex, and this could only be the result of brain-stem connections.

In presenting the first of the four cases of the Marcus Gunn phenomenon one can be certain that the onset of the phenomenon occurred very early in intrauterine

life, when the masses of orbital periaxial mesoderm should become differentiated into the oculomotor muscles. The failure of the development of these muscles may be ascribed to the failure of invagination of peripheralward developing (centrifugal) third-, and fourth-, and sixth-nerve motor fibers. Surgical exploration of this case showed, without any doubt, normal levators which must have been supplied by a portion of the oculomotor nerve, not sympathetic in nature. The other ocular muscles showed a pathologic condition. The degree of lid elevation was far greater than that possible by the unstriped muscles of the lid normally supplied by the sympathetic fibers, and the anatomic normalcy of the levators (seen surgically) seems to eliminate the possibility that the efferent pathway herein was sympathetic (autonomic) in nature.

Quoting Grant further: "Even if in the origin of congenital cases a pathway over which the synchronous movements are carried out could be worked out, the acquired type of associated movements could not be explained. Any presumption than an anomalous connection between the oculomotor and the other cranial nerves lies dormant waiting for the proper conditions to stir it into activity seems difficult to believe."

Stookey stated, in discussing Grant's¹³ original presentation, that since Grant's operation did not disturb an intra-axial internuclear connection between the motor nucleus of the fifth nerve and the nucleus of the third nerve, it was warranted, perhaps, in concluding that an intra-axial internuclear connection between these two motor nuclei did not play any role in the production of the syndrome. Stookey lost track of the fact that the afferent pathway can be proprioceptive and wholly sensory. As Grant said in concluding his presentation: "The most baffling part of the picture to me has been the fact that

the movement of the jaw has returned" (postoperatively in his patient) "but the movement of the eyelid does not accompany it."

In the case which Grant presented in his paper,¹³ he uncovered the gasserian ganglion through a temporal approach and sectioned the third division of the fifth nerve together with part of the ganglion that supplied the third division, trusting that by this maneuver he would cut the motor root as well. The patient had a very stormy recovery due to a secondary, postoperative, intracranial hemorrhage and temporary complete third- and seventh-nerve paralysis, but in a letter received by Grant one month after discharge from the hospital, the patient reported that he had no diplopia, no interference with vision, no recurrence of the associated movements, he had gained 20 pounds in weight, and the motor paralysis on the right side of the jaw in no way inconvenienced him.

The sensory afferent portion of the reflex arc is certainly granted. Equally certain is that the nerve pathways producing associated movement can be broken at either end. According to Grant, the afferent parts when injected (third division and motor root of the right fifth nerve) with procaine hydrochloride stopped the associated movement by preventing voluntary movement of the jaw to the left, and increased the ptosis of the right eyelid, making its voluntary elevation more difficult. It is conceivable that the injection reached the sympathetic fibers about the internal carotid artery, and hence increased the ptosis through the paralysis of the nonstriated fibers. It is significant (to this case of Grant's). Grant himself states: "However, in my experience the third division of the fifth nerve has been blocked many times with procaine, and this is the only incidence in which ptosis of the ipsilateral eyelid re-

sulted." (One must remember that the patient in Grant's case had primarily an established ptosis.) There are three possible reasons. The first has already been quoted, that is, the procaine injection might have reached the internal carotid sympathetic plexus, and increased the ptosis; second, the sympathetic fibers thus involved played an indefinite role in the complex efferent portion of the arc; and third, the somewhat later observation that the control of the afferent portion of the arc and its interruption by alcohol, did not increase the ptosis. Grant said in regard to this: "Since a much smaller amount of alcohol was used, little spread into the tissues occurred and the sympathetic fibers along the internal carotid were not affected." The intracranial surgery in Grant's case (exposure of the posterior two thirds of the ganglion and the sensory root with section of the third division and the motor root) could not have affected the sympathetic fibers along the carotid artery.

Of the four cases of jaw-winking to be presented, Case 1 developed his jaw-winking reflex with both the closure and the opening of the muscles of mastication, as well as with a side-to-side grinding movement. At the same time, this patient had a complete absence of movement of all the oculomotor muscles, except the sphincter iridis, the ciliary body (accommodation) and the two levators. There was certainly in this patient's case a congenital periaxial mesodermal nondevelopment of all of the oculomotor muscles which had to do with the movements of the eyeball, not including the normal iris sphincters. In view of the fact that only the levators functioned, they may be considered as part of the efferent portion of the arc of the Marcus Gunn phenomenon. Surgically, in this case, it was demonstrated that all of the extraocular muscles were present only as taut fibrous bands,

with the exception of the levator, but that the levators were perfectly normal, healthy muscle structures. When one considers the early intrauterine age at which the completed oculomotor third-nerve apparatus develops, it becomes evident that the period at which this syndrome formed, and was completed, was rather early in the growth of the fetus.

CASE REPORTS

*The first case*²² (figs. 2, 3, and 4) was that of a boy, aged 12 years, with bilateral ptosis of a high degree, with normal pupillary reflexes, with normal accommodation, and with both eyes directed strongly downward and to the left. Thus, the right eye appeared in downward and internal rotation, and the left eye in downward and external rotation. In this position of levoinfraduction, the visual axes were almost parallel horizontally, as well as vertically. The boy's visual acuity was not impaired when it was possible for him to use his visual axes for central vision. The lids lifted rather strongly with forcible closure of the jaws and even more so with a forcible hard opening of the jaws. Figures 2, 3, and 4 illustrate nicely the presence of the associated movements and the postoperative condition with prism glasses being worn.

The child was normal mentally, in fact, above average, but was very much handicapped by reason of his defect. The surgery for him was necessarily limited in that nothing could be done for the correction of the ptosis which would leave the cornea covered during sleep. Surgical exploration of his rectus muscles showed his strabismus fixus to be so marked that it was quite impossible to correct the hypotropia. A bilateral myectomy, therefore, was done of both levators, and the ptosis thus converted into a bilateral completely paralytic ptosis, now free of the jaw-winking associated reflex. Some time af-

ter this, a sufficient ptosis correction was obtained, by means of orbicularis transplants, so that the pupils were uncovered beneath the margin of the ptotic lids. The patient was then given prism spectacles for constant wear, bases up in both lenses

a most unfortunate and distressing neurosis, because of the conspicuous defect, and the curiosity of the unkind, though unintentional, comments of friends, adults, and other children.

This case was unilateral, on the right,



Fig. 2 (Spaeth). A, patient in repose with an almost complete ptosis. The orbito-palpebral fold is wholly missing. B, with the lids manually elevated, shows the bilateral hypotropia, somewhat dissimilar in degree, and with both eyes in partial left rotation. (Case 1).

permitting him to gaze directly to the front, though with his head still somewhat in a right-facing direction. The addition of two prisms, base to the right in the horizontal, corrected this right facing, but the amount of prism necessary made the spectacle lenses very heavy and conspicuous, and hence were not incorporated in the glasses. This patient has returned to school and is doing very well under his corrected conditions.

The second case was that of a girl, aged eight years, who had also had her condition since birth. This child was developing

developed only with the action of the pterygoids, did not appear with the action of the muscles which closed the jaw, and became very strongly accentuated when the patient looked downward while chewing.

Normally in downward gaze, the upper lid drops almost to the same level which it has with a normal closure of the palpebral fissure. Synchronous depression of the lower lid permits continued unimpeded downward vision. The elevation of the ptotic lid from this level of maximum depression is a third-nerve levator func-

tion and not a sympathetic-supplied, unstriped lid-muscle function and achievement. Later in this case, one could see that there was no doubt whatsoever of this. A myectomy of the levator muscle resulted in a complete cessation of the associated reflex. The sympathetic innervation of the

lower lid is a much less definite structure and not easily recognizable by dissection, it still is active in function and is innervated by the same group of sympathetic fibers related to the cervical sympathetic carotid cavernous sinus plexuses which supply the upper lid. The com-



Fig. 3 (Spaeth). Lids, upper, lifted in an associated reflex by strong closure of the jaw, A; and an even better elevation, B, by violent opening the lower jaw. Orbito-palpebral folds are very evident now and their position seems to be levator in origin, rather than autonomic. In A, the occipito-frontalis seems to assist in the elevation but this is not so in B. At this time the eyebrows are the lowest ever seen at any time, probably the only time relaxed. (Case 1).

non striped muscles of the lids, however, was not touched, but Müller's muscle itself, by reason of its position beneath the aponeurosis of the levator, was sectioned with the levator fibers. The reflex was stopped by sectioning the muscles innervated by a somatic and an autonomic nerve, each a possibly efferent pathway. While the orbito-palpebral muscle of the

plete lack of any pathologic condition in this associated reflex, before or after the myectomy, in the lower lid seems to suggest a greater significance for the somatic nerve supply.

*The third case*²³ was that of a 15-year-old girl, highly myopic. Although a moron, the patient had developed rather well into a third- or fourth-grade school



Fig. 4 (Spaeth). Case following surgical exploration of the oculomotor apparatus, following resection of the levators, and after orbicularis transplants for the ptosis. The patient is shown, as well, wearing his prism glasses. (Case 1).

level by the age of 15 years. There was a suggestion of bilateral obliquity of the palpebral fissures. The patient had a paresis of both external rectus muscles, a paralysis of the superior rectus on the right and a partial paralysis of the right inferior rectus muscle. There was a partial paralysis of the levator on the left, and a partial paralysis of the superior oblique on the left as well. *Both upper eyelids* entered into the jaw-winking re-

flex but it was most marked upon the left. As a result of her various oculomotor palsies, this girl had developed a spasm of the inferior oblique muscle upon the left and some overaction, relative at least, of the right inferior rectus muscle. (See figure 5 of the patient in repose.) Even more remarkable were other dissociations of the actions of the extraocular muscles. In downward gaze, the upper lids lagged definitely (fig. 6) behind the movement



Fig. 5 (Spaeth). In repose the patient shows nothing but a bit of ptosis in the upper lid (O.S.).



Fig. 6 (Spaeth). Elevation of both upper lids in downward rotation of the eyeballs, an intraneural, third-nerve, pathologic association.



Fig. 7 (Spaeth). Downward rotation to the left, a greater elevation now occurs in the left upper lid, showing the effect of the parietic external rectus on the left.



Fig. 8 (Spaeth). Downward rotation to the right. In this instance, there is a still stronger elevation of the right upper lid. The left lid remains unchanged.



Fig. 9 (Spaeth). Attempted right lateral rotation, now a demand only upon the right external rectus, results in the greatest amount of elevation of the upper lid. This shows an interneural third- and sixth-nerve association.



Fig. 10 (Spaeth). Left lateral rotations result in a bilateral elevation of the upper lids, more marked in the left, again an interneural as well as intraneural association, perhaps less conclusive than that seen in the right, Figure 9.

of the eyeballs. This was rather startling in appearance. In downward movement to the left, the right upper lid was lowered a bit more than on left (fig. 7). In attempted downward movement to the right, the right upper lid lifted very strongly while that on the left remained unchanged (fig. 8). The downward movements of the eyeball to the right were greatly limited. Right lateral rotations of both eyeballs to the right resulted in an even stronger elevation of the levator upon the right side (fig. 9). Rotations to the left caused similar but now bilateral elevations (fig. 10).

The fourth case is the most amazing of them all in a demonstration of intracranial-interneural relationships. The young man, B. J., aged 26 years, had had ptosis his entire life, and this was the reason for his initial examination. The

young man showed a classical jaw-winking reflex of the left upper lid, present with all chewing movements, closure as well as the lateral movements of the lower jaw. In repose, he had a complete paralysis of the upper lid, and with it a complete paralysis of the superior rectus muscle. In eyes front, fixing with the right eye, there were 40 degrees of left hypotropia. In the left lateral rotations, the patient developed 60 degrees of right hypertropia from the wild overaction of the right inferior oblique muscle.

The internal and inferior rectus muscles showed in their rotations normal amplitude. The action of the left inferior oblique muscle was greatly limited. In spite of the apparent complete paralysis of the superior division of the third nerve, the jaw-winking, associated reflex in the upper lid on the left was quite

active. In addition, however, in repose there was an almost constant asymmetric opening and closing of the upper lid, greatest in amount when the patient was animatedly engaged in conversation upon some subject other than his eyes. The movements of this lid were wholly separate from those normal movements in the right upper lid. Frequently, there was quite a see-saw action of these two lids; that is, a normal blinking closure of the right upper lid was simultaneous with a rather wide opening movement of the left upper lid.

Demand for movement in the paralytic superior rectus muscle (upward gaze) minimized to a great extent these movements of the upper lid, although some still continued. A demand for the use of the paretic inferior oblique muscle did not modify them in any way whatsoever. In this case the upper lid was completely paralyzed to all voluntary movements; nevertheless, there was a constant action of the upper lid, not sympathetic in origin (autonomic nerve supply), and this was inhibited rather definitely in upward gaze—now a demand upon the paretic superior division of the oculomotor nerve.

These movements occurred rather asymmetrically, although constantly. The lid movements which developed with chewing were rhythmic and synchronous with the motions of the lower jaw.

Acetylcholine stimulation cannot be the answer to this disorder. The jaw-winking association is only a part of the condition as seen. The condition is not the result of cervical-sympathetic stimulation, neither normal in degree nor in relative overstimulation because of the levator paralysis, and these lid movements were definitely inhibited by attempted upward gaze even though the eye did not and could not move upward.

From these pathologically associated

movements one can see that binocular stimulation, when downward movements are demanded, results in some elevation (retarded depression) of the upper lids. When demands in addition are made upon either of the paretic external rectus muscles, a very strong additional elevation occurs in the lids; namely, the levators. The first of these situations can be a misdirection of a portion of the third-nerve inferior rectus muscle fibers into the levator fibers, fibers destined for the inferior division of the third nerve terminating in the superior division. This might well be a confusion occurring within the trunk of the third nerve itself. When lateral rotations are demanded (in the second situation of these two), however, the associated ocular-muscle reflex can be answered only upon the basis of excess acetylcholine formation, through emotional (cerebral) stimulation, by sympathetic stimulation, or because those fibers which should have terminated in the external rectus muscles have found their way, in some bizarre association, with the third-nerve nuclei or the third-nerve intranuclear tracts. This association could hardly be outside the brain stem. The pathologically associated jaw-winking reflex in this case was present bilaterally but much more marked upon the left side. The case, therefore, appears to be a congenital type of an internuclear syndrome involving the third nerves, the motor divisions of the fifth, the sensory divisions of the fifth, and the sixth nerve (the cranial nerves bilaterally), of dissimilar degrees, however, and associated with other manifestations of higher cerebral disturbances.

The analysis of a case of the acquired form of these faulty intraneural associations connected with regeneration of oculomotor-nerve fibers, that is the pseudo-Graefe syndrome, is significant to these congenital forms of malassociation.

In Case 1, herein presented, the patient had a paralytic levator, a paralytic superioris rectus, and a paretic inferior rectus and inferior oblique, and an internal ophthalmoplegia. The internal rectus showed some return of function. The pupil was widely dilated and fixed. (Normally the third-nerve fibers to the sphincter iridis pass to the iris by way of the branch of the third nerve to the inferior oblique muscle.) In this case when maximum regeneration had occurred in the third-nerve trunk, fibers destined for the internal rectus found their way into the levator, in that, with contralateral rotations, the lid lifted. When downward rotation was called upon, that is, the functioning of the incompletely paralyzed inferior rectus, the pupil contracted; hence, fibers which terminated in the sphincter iridis had been destined for the inferior rectus muscle, and in some way had passed to the ciliary ganglion and to the sphincter iridis. There was no inferior oblique, levator, nor superior rectus regeneration whatsoever; hence the direct or reestablished peripheral connection is uncertain.

This confusion of terminal fibers occurred infranuclearly from some point in the trunk. The traumatism responsible for the initial third paralysis was intracranial and at the base. Considering the contralateral hemiplegia (hemiplegia alternans superioris) which the patient had at that time, the third-nerve paralysis was a part of an interpeduncular syndrome. The important question here is "at what point did the regeneration begin?" Certainly before the third nerve split into its two major intraorbital branches. The fact that internal rectus fibers passed through to the levator is evidence of this.

Another interesting speculation in regard to this case is to hazard a guess as to why there was such extensive regeneration of the internal rectus fibers

and the sphincter fibers; partial regeneration of the inferior rectus fibers; and no regeneration whatsoever of the true fibers for the levator, superior rectus, and the inferior oblique muscles. The nerves to these muscles have their terminal distribution in both the superior and the inferior major orbital terminations. This seems to suggest that regeneration of the third-nerve fibers might have started considerably higher in the course of the third-nerve trunk than even the interpeduncular space.

The successful surgery in this case inspired the surgery for the Marcus Gunn phenomenon. The gross paralytic oculomotor defect was first corrected because of the paralytic divergent squint (recession of the external rectus with resection of the internus). The pseudo-Graefe syndrome was then changed to a completely paralytic form of ptosis by a thorough myectomy of the levator including the two lateral horns. This paralytic ptosis was then subsequently corrected by a Reese orbicularis transplant.

The surgery carried out for the pseudo-Graefe syndrome was applied as satisfactorily to cases with the Marcus Gunn phenomenon. In Grant's case, the afferent proprioceptive pathway was sectioned intracranially, in the oculomotor extracranial surgery the efferent motor path is destroyed and the subsequent defect corrected by means already well-known. It is a logical procedure and without the dangers and complications attendant to that seen in Grant's presentation.

The surgery in Case 3, herein presented, was decidedly simplified in that the paralytic ptosis which occurred following the myectomy of the levator on the right side could be fully corrected by orbicularis transplants without any limitations in surgery, since there were no other disturbances with the remaining ocular muscles.

CONCLUSIONS

The underlying pathology of the Marcus Gunn phenomenon has been discussed, in part, with the consideration of the theories which have seemed plausible, although without a satisfactory conclusive solution.

There is a possibility that some of the cases of these pathologic associated reflexes might be the result of an afferent proprioceptive reflex pathway and a sympathetic (autonomic) efferent pathway as seen experimentally.

It is certain that other cases may appear with brain-stem internuclear, pathologic, anatomic connections as the cause of the associated reflex.

It is probable that other cases of associated reflexes have an origin in supranuclear higher cerebral centers, for emotional stimulation plays an indefinite but likely role. Of the three cases presented, the first demonstrated the very early development of the pathologically associated reflex in terms of intrauterine life.

Case 2 showed no pathologic condition whatsoever except a unilateral pathologic associated reflex and demonstrated a lack of any certain autonomic relationship. Sectioning the efferent pathway, that is the muscle supplied by a somatic nerve, abolished the reflex.

Case 3 showed a gross bilateral nuclear and tract pathologic condition involving

the third, fourth, fifth, and the sixth cranial nerves, all with varying degrees of unilateral and bilateral paralyses. One portion of the associated reflexes here had its afferent origin in the muscle supply of the pterygoids. Another portion arose in the brain stem and was associated with the innervation called upon for right and left gaze. A third portion was apparently a peripheral misdirection of the third-nerve fibers.

Case 4 is similar to Case 3 in some points. It shows a dual cause for the jaw-winking reflex, one separate from the other; one is associated as a reflex, but the other is rather certainly a pure central-nuclear or supranuclear condition. This demonstrated something akin to an inhibitional palsy; that is, inhibition of the reflex with central stimulation for upward gaze. It seems that this case presents a very strong brief for the likelihood that the condition could be a brain-stem, intranuclear syndrome.

Cannon's law of denervation and its relationship to acetylcholine was considered and discussed in relationship with the previous work of Grant, Groff, and Lewy.

Surgery, as an ophthalmic procedure, is stressed, as indicated, for the condition. An intracranial approach, it appears, is not necessary for the correction of these cases.

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GONIOSCOPY*

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The purpose of this communication is to present a simple technique of low magnification gonioscopy and to show the findings of the examinations made by this method. The instruments that have been designed for gonioscopy have high magnification which is associated with restricted depth of focus. They are also somewhat heavy, which, for the beginner who takes longer to make the examination, causes fatigue. With the lower magnification, the beginner more easily orients the landmarks of the angle. For these reasons, the method is presented for the beginner; it is not intended to replace the examination made with higher magnification. Inasmuch as the technique is simple and the equipment inexpensive, it would seem it should be added to the diagnostic armamentarium of the ophthalmologist. Its continued use has shown that it is not just another examination and a passing fancy.

The examination is made with the goniolens as described by Troncoso.¹ The eye is anesthetized with pontocaine and the upper edge of the lens inserted under the margin of the upper lid while the patient looks down. The lower edge of the lens is inserted under the margin of the lower lid while the patient looks up. When the interpalpebral fissure is large or the lid muscles relaxed, it may be necessary to hold the lens on the eye with slight pressure of a cotton applicator or with the rubber suction nipple used to hold the lens while inserting it. For small interpalpebral fissures and for patients with pronounced blepharospasm, a smaller size

goniolens is advisable. After insertion of the lens, the space between the lens and the cornea is filled with saline solution. The presence of bubbles interferes with the examination and they must be removed. No injury has resulted from the examination except when the goniolens was left on unduly long; this resulted in



Fig. 1 (Sheppard and Romejko). Technique of low-magnification gonioscopy. (Photograph by courtesy of the Variety Club of Washington, D.C.).

slight discomfort only. The examination of the angle is made by using the ordinary loupe and the illumination of the ophthalmoscope from which the head, but not the condensing lens, has been removed.

In learning the technique and orientation, it is preferable to start with normal eyes and with eyes which have deep anterior chambers. As one becomes more adept in the examination, it can be used in cases of glaucoma in which it serves, not to make a diagnosis, but to differentiate

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the wide- and narrow-angle types. Its value in surgery, preoperatively and post-operatively, has been given by Troncosco,² Sugar,³ Troncoso and Reese,⁴ and Meyer

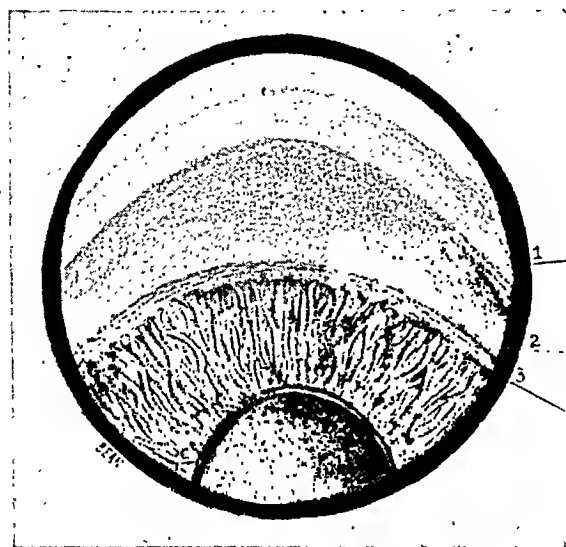


Fig. 2 (Sheppard and Romejko). A normal angle. 1, cornea. 2, trabecular spaces. 3, ciliary-body band.

and Sternberg.⁵ While its major indication is in glaucoma, Moreu⁶ lists 11 groups of cases which he has studied by means of gonioscopy. These groups include congenital, traumatic, and inflammatory conditions; conditions caused by malnutrition, atrophy, anterior synechia, tumors and pseudotumors, and glaucoma; as well as conditions occurring after iridectomy, postoperatively and in fundus disease. Sugar⁷ gives cases other than glaucoma in which its use is indicated; namely, anomalies, hydrophthalmos, congenital megalocornea, congenital coloboma, aniridia, tumors, cysts, tuberculosis, trauma, and inflammatory lesions.

CASE REPORTS

GROUP I (NORMAL)

In making the examination one starts at the pupillary border of the iris and follows it back to the "last roll of the iris." Sometimes this roll is so pronounced that

it is impossible to "see over the hump." (Kronfeld⁸). Usually a small darker band can be seen—the ciliary portion of the iris. Beyond this may be seen the fine strands of the pectinate ligament, like fine spider webs. The trabecular spaces are identified by a more or less pigmented dotted line. Above this is the corneal endothelium underlying the limbus (fig. 2).

GROUP II (TRAUMATIC)

Case A. D. C., a man aged 49 years, was a grocer. On September 11, 1944, his right eye was injured when a beer bottle exploded. There was a laceration of the cornea, just within the limbus at the 12-o'clock position through which the iris had prolapsed. An iridectomy was done, followed by a conjunctival flap. Figure 3 shows the edges of the iris caught in the

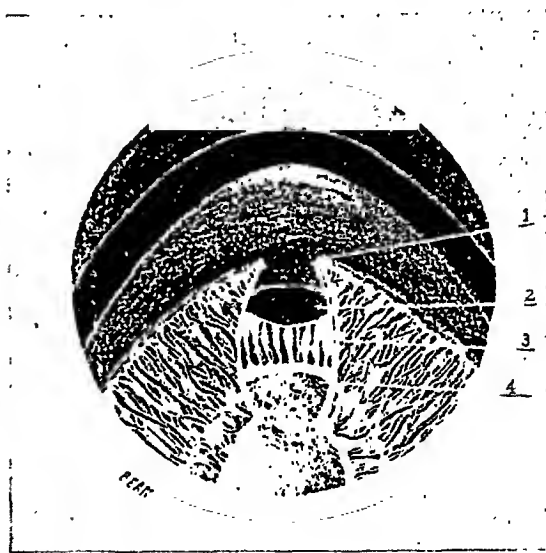


Fig. 3 (Sheppard and Romejko). The edges of the iris caught in the wound. 1, peripheral incarceration of iris pillars in wound. 2, dialysis of ciliary body. 3, ciliary processes. 4, edge of lens.

wound, traumatic ciliary-body dialysis, and the normal ciliary processes. At the last examination on July 25, 1945, the eye was quiet and corrected vision was 20/15—1.

Case B. L. K. C., a woman aged 28 years, was in an automobile accident on January 8, 1945, and suffered a laceration of the cornea of the left eye with prolapse of the iris at the 6-o'clock position. An iridectomy was performed, followed by a conjunctival flap. Figure 4 shows the peripheral incarceration of the iris in the wound. Resulting vision was $20/20\pm$, unimproved with glasses due to a slight central nebula of the cornea.

Case C. A. S. J., a woman aged 28 years, had both eyes injured in a powder explosion on July 1, 1944. Examination

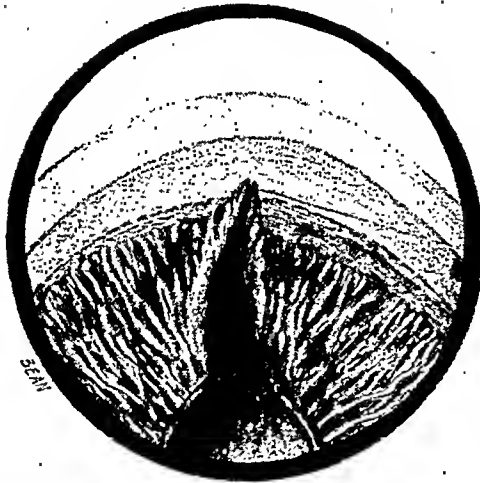


Fig. 4 (Sheppard and Romejko). 1, iridectomy with peripheral incarceration of the pillars of the iris.

was made on March 15, 1945. Vision was $20/30$ in the right eye; $4/200$ in the left. This reduction in vision was attributed to traumatic central choroiditis in each eye as well as to changes in the posterior capsule of the left lens. Gonioscopic examination of the left eye showed peripheral anterior synechiae, iritis deposits on the corneal endothelium in the angle similar to the iritic deposits on the anterior capsule of the lens following the breaking up of posterior synechiae, and dialysis of the ciliary body. In the area

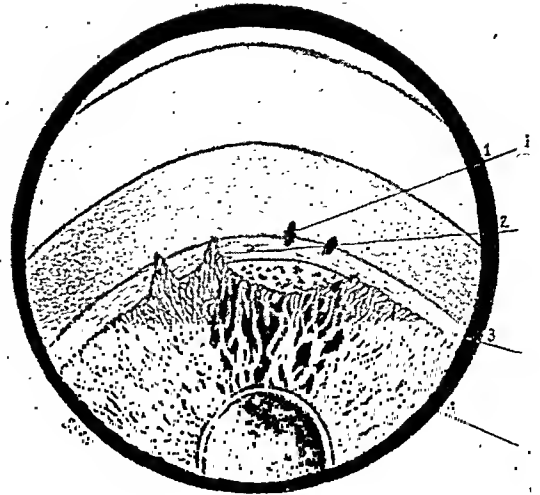


Fig. 5 (Sheppard and Romejko). An eye injured in a powder explosion. 1, remnants of peripheral synechiae in angle. 2, peripheral anterior synechiae. 3, partial dialysis of the ciliary portion of the iris. 4, atrophic portion of the iris.

of this dialysis, the under surface of the sclera was dotted with pigment. The iris in the area corresponding to the dialysis was atrophic (fig. 5).

Case D. B. C., a man aged 24 years, was injured in the right eye on April 11, 1945. A foreign body was removed by magnet

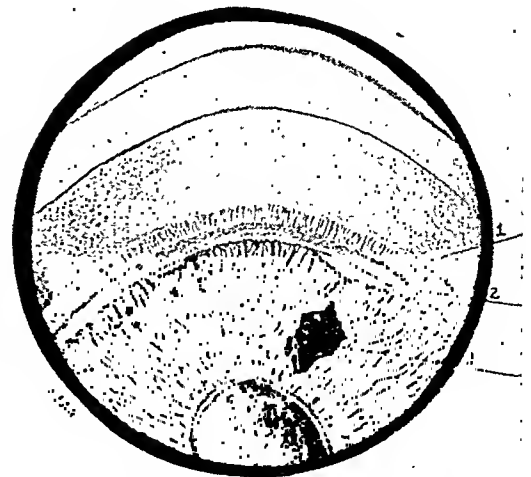


Fig. 6 (Sheppard and Romejko). An eye injured by a foreign body. 1, trabecular spaces. 2, partial dialysis of ciliary body. 3, laceration of iris.

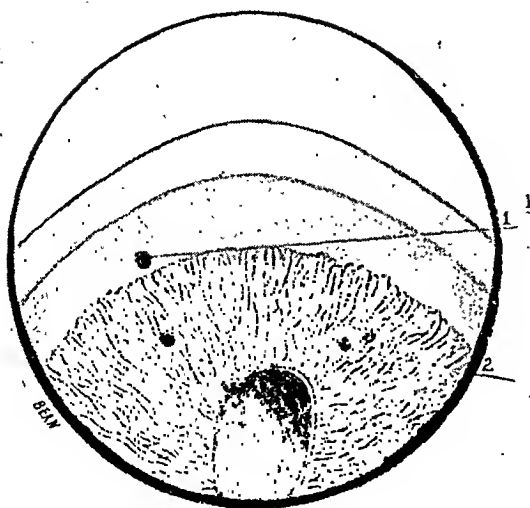


Fig. 7 (Sheppard and Romejko). Without gonioscopic examination, the foreign body in the angle would have been missed. 1, foreign body in the angle behind the limbus. 2, foreign bodies on the iris.

on April 16, 1945. Gonioscopic examination showed a slight dialysis of the ciliary body, a deep angle, and a hole in the iris (fig. 6).

Case E. K. B., a man, aged 19 years, was injured in both eyes when a dynamite cap exploded in April, 1944. Examination on July 26, 1945, showed vision to be: O.D., 20/200, with a + 8.00D. sph. \ominus +2.75D. cyl. ax. 160° ; O.S., 20/15-2, with a +10.75D. \ominus sph. \ominus +1.00D. cyl. ax. 75° . The reduced visual acuity in the right eye was due to a traumatic cataract. There was also a detached retina of the right eye. X-ray studies showed the shadow of a foreign body in the right eye. In the left eye, there were several foreign bodies on the iris and one in the angle. These were too small to be demonstrated by X ray. Without gonioscopic examination, the foreign body in the angle would have been missed (fig. 7).

GROUP III (GLAUCOMA)

Case A. Wide angle glaucoma simplex of the pigmentary type. W. L. C., a

woman, aged 43 years, was examined on October 22, 1943. Corrected vision was 20/20-1 in the right eye; 20/20+3 in the left eye. There was cupping of the discs, more so of the right. Tension was: O.D., 40 mm. Hg (Schiotz); O.S., 25 mm. Treatment started with $\frac{1}{4}$ -percent pilocarpine nitrate, four times a day, which was gradually increased to 4-percent pilocarpine, four times a day. Iridencleisis of the right eye was done on January 9, 1945, and of the left eye on December 11, 1945. The tension on January 25, 1946, was 17 mm. in the right eye; and 13 mm. in the left eye. Gonioscopic examination showed the trabecular spaces so filled with pigment that the appearance was one of a straight black line (fig. 8).

Case B. Secondary glaucoma. Uveitis of undetermined origin. M. D. F., a woman, aged 71 years, had an attack of acute glaucoma in the right eye on March 16, 1944. Tension was O.D., 80 mm. Hg (Schiotz); O.S., 25 mm. The tension of the right eye was reduced to 40 mm. by myotics and on March 20, 1944, an iridencleisis was done. Preoperatively, there was no slitlamp evidence of uveitis in either eye. By mistake atropine was used

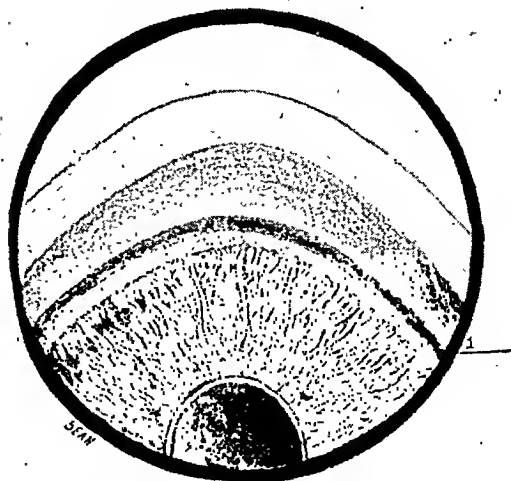


Fig. 8 (Sheppard and Romejko). Wide angle glaucoma simplex of the pigmentary type. 1, trabecular spaces blocked with pigment.

in the unoperated left eye and this revealed an irregular pupil, due to posterior synechiae. Gonioscopy of the left eye showed three marked peripheral anterior synechiae and deposits on the lens and on the corneal endothelium. Tension in the left eye has been fairly well-controlled by repeated paracenteses. The outcome of the right eye has been unsatisfactory due to uveitis (fig. 9).

Case C. Secondary glaucoma. Uveitis of asymptomatic malarial or tuberculous origin. L. B., a woman, aged 25 years,

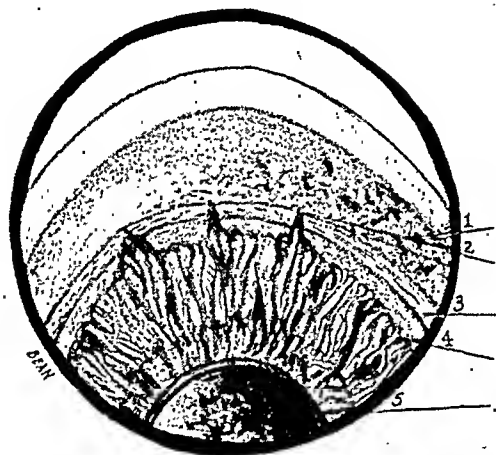


Fig. 9 (Sheppard and Romejko). Gonioscopic picture of an eye with secondary glaucoma and uveitis of undetermined origin. 1, deposits on the corneal endothelium. 2, anterior peripheral synechiae. 3, trabecular spaces. 4, ciliary-body band. 5, iritic deposits on the anterior surface of the lens.

was seen on January 30, 1941, when the left eye had deposits on the corneal endothelium and tension was 22 mm. Hg (Schiøtz). On March 6, 1941, the tension had increased to 32 mm. but dropped to 17 mm. the following day. The tension has fluctuated with repeated attacks. Paracentesis was done on April 17, 1945. Gonioscopy showed a large peripheral anterior synechia with occasional openings. The pectinate ligament was more pronounced than normal and at first sug-

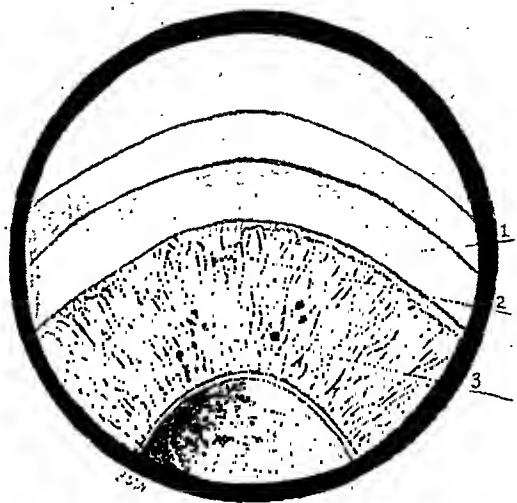


Fig. 10 (Sheppard and Romejko). Gonioscopy showed a large peripheral anterior synechia with occasional openings. 1, pectinate ligament extending from the root of the iris to the upper border of the trabecular spaces. 2, in two places the ciliary portion of the iris can be seen. 3, a few pigment spots on the iris.

gested newly formed fibrous tissue (fig. 10).

*Case D. Leiomyoma of the iris.*⁹ M. L., a 27-year-old woman, had had a brown spot in the inferior temporal part of the right iris for as long as she could remem-

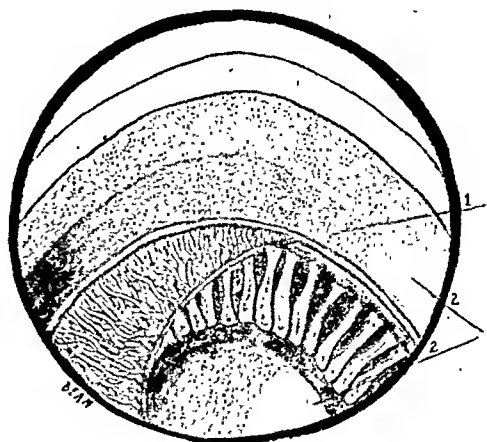


Fig. 11 (Sheppard and Romejko). Gonioscopy showed the root of the cut iris and the ciliary processes. 1, iridectomy for leiomyoma of the iris. 2, corneal and lenticular haze due to pressure of the tumor.

ber. Iridectomy was performed on January 5, 1943. Gonioscopy showed the root of the cut iris and the ciliary processes. At the last examination on January 31, 1946, there had been no recurrence of the tumor. The corneal endothelium upon which the tumor pressed has very gradually become less transparent. This very slight and slow increase in loss of transparency has not extended beyond the original area of pressure. The corneal epithelium in the corresponding area has begun to show evidence of edema (fig. 11).

In making the gonioscopic examinations, two cases of iridodonesis have been unexpectedly found. The tremor of the iris is magnified and much more easily seen when looking in the plane of the iris than when looking at right angles to it. One patient had a cataract, the operation of which was undertaken with greater con-

fidence because to be forewarned was to be forearmed.

CONCLUSIONS

1. A simple technique of low-magnification gonioscopy is presented.
2. The method is of value to the beginner because of the greater ease in orientation.
3. The indications for gonioscopy are not limited to glaucoma but it should be a routine examination in glaucoma and in intraocular surgery both preoperatively and postoperatively.
4. Iridodonesis is magnified by this method of examination and is therefore more easily diagnosed.

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POSTNEURITIC OPTIC ATROPHY IN REPATRIATED PRISONERS OF WAR

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During the war years, there were many reports of visual disturbances in individuals who were forced to live under inadequate dietary conditions.¹⁻⁴ We have had an opportunity to study such disturbances in men returned from Japanese prison camps. The incidence of permanent visual impairment was alarming and has been confirmed in many Army and Navy hospitals.

Reviewing publications of the past decade concerning nutritional diseases in which vision failure was an outstanding symptom, we find many convincing reports. Krylov⁵ described 36 cases of pellagra in natives of the Caucasian mountains with accompanying optic-nerve pathosis. He observed paleness of the nerve head with scotomas for red and green.

Moore^{6, 7} described a common disease in adolescent school boys in which loss of central acuity of vision associated with sore tongue and mouth were predominant features. Avitaminosis was suspected as the causative factor, because girls, who received supplementary feedings at school, appeared immune to the disease. A number of the patients were treated with cod-liver oil, malt, marmith, and iron with successful results. Moore concludes that the prognosis for the return of vision in cases of less than six months' duration was excellent, but if the duration were over six months, the prognosis must be guarded.

Moore⁸ also described a syndrome of glossitis, stomatosis, pruritis of the external genitals, and dimness of vision with loss of central acuity. School children were particularly affected. In the

author's opinion, based on the observation of some 300 cases, the disease was caused by the use of "gare," a common and cheap food, with inadequate supplementary food.

Other reports, notably those of Levine,⁹ of Fine and Lachman,¹⁰ Ramon and Abbu,¹¹ and Verma,¹² point conclusively to the part avitaminosis can play in the production of optic neuritis.

Probably the most complete recent study made on this subject was that of Spillane and Scott.¹ They described a peculiar neurologic syndrome consisting of retrobulbar neuritis, nerve deafness, and ataxic paraplegia in 112 prisoners of war. The majority of these cases came from one camp. A nutritional neuropathy seemed the most probable explanation of the illness, since there was no evidence of poisoning, infection, or other cause. Peraita,² Wilkinson and King,³ and Whitacre,¹³ all describe similar syndromes in people living under war conditions. Although these described changes are thought to be nutritional in origin, the response to vitamin therapy has not been very satisfactory.

A brief summary of six representative cases which we have been told are typical of those seen at other military hospitals will follow. It should be emphasized that we saw all these patients from two to three years after the original visual symptoms developed and that we are observing the terminal effects of the nutritional neuropathy. We had to rely entirely upon the history from the patients as to when the visual impairment started; what treatment, if any, was given; whether or not other nutritional syndromes, such as def-

inite beriberi and pellagra, were present. We are presenting these cases as a contribution to the number of similar, previously reported cases, hoping to emphasize the importance of an adequate diet especially for people living under war conditions and to point out the marked visual incapacitation that can result from neglect to supply such a diet.

CASE REPORTS

Case 1. J. M. B., PI/Sgt. U.S.M.C., aged 45 years, was captured at Wake Island on December 23, 1941. He was confined in two camps in China and two camps in Japan. He first noticed blurred vision in September, 1942. This blurring increased gradually until January, 1943. Since that time, he feels that there has been no change in his vision. He stated that he had had no specific nutritional disease but suffered from severe malnutrition and lost considerable weight (the exact amount was not known). He received some cod-liver oil and vitamin-C tablets intermittently with no improvement in his vision.

Ocular examination at this hospital, three years after the onset of symptoms, showed vision in each eye to be 2/20, unimprovable. The media were clear, and the fundi showed the disc margins to be indistinct with slight temporal pallor. Perimetric examinations revealed the peripheral fields to be normal. The central fields showed bilateral, absolute, central scotomas of around five degrees.

Case 2. J. D. S., Sgt., U.S.M.C., aged 25 years, was captured on Corregidor, May 6, 1942. He was confined in two camps in the Philippines and one in Japan.

He first began to notice visual impairment in January, 1943. At this time, his diet consisted of boiled rice, potatoes, and occasionally meat. He received some vitamins and eye drops about six months after his vision began to fail. There was some

improvement in vision for a period of about three months. He soon noticed a return of the blurred vision, however, and there was no change during the last 20 months of his internment. He suffered from pellagra, beriberi, and diarrhea while he was a prisoner.

Upon examination at this hospital three years after the onset of symptoms, vision in each eye was found to be 2/20, unimprovable. Funduscopy examination showed a temporal pallor of the disc in each eye, with a granular appearance of both maculas. Perimetric examination revealed bilateral, absolute, central scotomas. The peripheral fields were normal.

Case 3. I. C. S., S/Sgt. U.S.M.C., aged 24 years, was captured on Bataan, on April 9, 1942. He was confined in three Philippine prisons and one in Japan. He first noticed impairment in his vision in April, 1943. At that time his diet consisted of rice and thin green soup and, occasionally, meat. He was given vitamin A in small quantities for his eye symptoms, with slight improvement. His vision gradually failed the last year of his confinement and has remained stationary since then. He had "wet beriberi" at the onset of his visual loss.

Upon examination in this hospital, three years after the onset of his symptoms, vision in each eye was found to be 2/20, unimprovable. Funduscopy examination of each eye revealed temporal pallor of both optic discs. The macula in each eye was granular in appearance, and the light reflex was absent. Perimetric examination of both eyes revealed absolute central and paracentral scotomas, with normal peripheral fields.

Case 4. K. K. K., PI/Sgt. U.S.M.C., aged 35 years, was captured on December 23, 1941, on Wake Island. He was imprisoned in several camps in China and Japan. He first noticed blurring of his vision in August, 1942. At that time he

was eating small quantities of rice, stew, watery fish stew, and, occasionally, vegetables. He believed he received ascorbic-acid injections for 44 days in 1942. In 1943 and 1944, he received nine vitamin pills daily for a total of 45 days. He stated that there was improvement of his vision on this therapy. When it was discontinued, however, the improvement was not sustained. He had had beriberi, pellagra, and malnutrition, with a weight loss of 37 pounds.

Examination at this hospital 3½ years after the onset of the loss of vision, revealed the vision in each eye to be 10/20, unimprovable. Funduscopy examination of each eye revealed slight temporal pallor of the optic discs and granular maculas, with absent light reflexes. Perimetric examination showed absolute central scotomas bilaterally, and a contracted, left peripheral field.

Case 5. H. M. E., Pfc. U.S.M.C., aged 31 years, was captured on Corregidor, May 6, 1942. He was confined in three camps in the Philippines and one in Japan. His vision first became impaired in November, 1942, at which time he had had corneal ulcers. At the time of onset of symptoms, his diet consisted of rice and vegetable soup in small quantities. After the onset of symptoms, he was given one tablespoon of cod-liver oil a day for two months, plus one vitamin-A pill a day for two weeks. He stated that his ulcers healed in three months but that his vision never did clear. He had beriberi in 1943.

Examination at this hospital, four years after the onset of the visual symptoms, showed this patient to have corneal opacities in both eyes. Vision in the right eye was 2/20, improvable with homatropine dilatation to 6/20. Vision in the left eye was 6/20, improvable to 8/20, with homatropine dilatation and a -1.25 sphere. Slitlamp examination revealed

central corneal opacities of both eyes, but the periphery of each cornea was clear. Funduscopy examination revealed slight temporal pallor of the optic discs. Perimetric examination showed some constriction of the right peripheral field with normal central fields. An optical iridectomy of the right eye was done, with visual improvement to 6/20.

Case 6. J. B. G., BMLC U.S.N., aged 26 years, was captured on Corregidor, May 8, 1942. He was imprisoned in several camps in Japan. In September, 1942, he began to complain of a sore tongue and blurred vision. At that time, he also noticed some heaviness and weakness of his legs. In spite of these complaints, he was forced to do heavy physical work. Two months later he complained of severe shooting pains in his legs, became suddenly paraplegic, and lost control of his sphincters. He was diagnosed as having beriberi and was immediately transferred to Japan. At this time, he stated, he was almost blind. Six months after his arrival in Japan, he developed a corneal ulcer in his left eye. This cleared up after a long period of convalescence. Beginning in the spring of 1943, there was a gradual improvement in all of his symptoms for a period of six months. Since the fall of 1943, there has been little change in his condition. He was hospitalized continuously until his liberation and, during that period, he lost 110 pounds in weight.

Examination at this hospital, 3½ years after the onset of his symptoms, revealed vision in the right eye to be 5/20; and in the left eye 1/20, unimprovable. Slitlamp examination revealed a large, central scar of the left cornea, with an anterior synechia of the nasal pupillary portion of the iris to the scar. The left lens showed some anterior-capsular opacities. Both fundi were seen and appeared normal. Perimetric examination revealed constriction of both peripheral fields, more

marked in the right eye. The left eye showed an absolute central scotoma, and the right eye an absolute paracentral scotoma.

DISCUSSION

The existence of food-deficiency diseases in these cases was undeniable. All of these patients, except one, gave histories of having suffered from beriberi or pellagra, and all had suffered severe malnutrition, with marked loss in weight.

There has been some controversy as to which vitamin deficiency was responsible for this type of optic-nerve degeneration. Mellonby¹⁴ showed that vitamin-A deficiency in dogs was associated with severe degeneration of the afferent nerves, including the optic nerve. Rao¹⁵ observed myelin degeneration in the optic nerve of rabbits, rats, and fowls fed on diets lacking in vitamin A. Vitamin-B₁ deficiency has long been associated with retrobulbar neuritis and optic-nerve degeneration. Rea,¹⁶ Ramon and Abbu,¹¹ and Landor and Pallister¹⁷ reported cases of optic-nerve degeneration in a vitamin-B₂ deficiency syndrome. A large group of patients from the Japanese prison camps were carefully studied by McDaniel and others.¹⁸ The clinical findings for these patients indicated definite deficiency in the vitamin-B complex, extrinsic factor, and protein.

The fundusoscopic appearance of the cases herein reported was fairly uniform. All but one case showed slight temporal pallor of the discs; foveal light reflexes were absent; and the maculas had a granular appearance. Visual acuity varied from 1/20 to 10/20. The visual fields were recorded on a perimeter and Bjerrum screen at one meter. The peripheral

fields were constricted in only two cases; and all but one case showed bilateral absolute central or paracentral scotomas. These findings are similar to those described by other observers.

All these patients were given intensive dietary therapy upon liberation. McDaniel and others¹⁸ described the dietary management of the repatriates, and it is reasonable to assume that this regime was fairly well standardized. Ninety percent of the men were given six full meals a day, in addition to ice cream and chocolate bars. It was estimated that a 5,000-calorie diet was given, supplemented with the following vitamin intake:

Vitamin A	15,000 units
Vitamin B ₁ (thiamin)	20 mg.
Vitamin B ₂ (riboflavin)	10 mg.
(niacinamide)	60 mg.
Vitamin C (ascorbic acid)	225 mg.
Vitamin D	1,200 units

In no case, as determined by the visual examinations on repatriation, did the visual examinations during this therapeutic regime show any change. This tends to substantiate Moore's⁶ observation that the prognosis of the return of vision in cases of longer than six months' duration must be guarded.

SUMMARY

Since the return of personnel from the Japanese prisoner-of-war camps, most ophthalmologists in Army and Navy hospitals have seen permanent visual impairment which in all probability is nutritional in origin.

We have presented six typical cases of severe ocular disability the onset of which was concomitant with marked dietary deprivation.

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NUTRITIONAL RETROBULBAR NEURITIS IN CHILDREN IN JAMAICA

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Dimness of vision associated with impaired hearing was mentioned by H. H. Strachan¹ in accounts of peripheral neuritis in Jamaica in 1888 and 1897. This condition occurred in adults as well as children. H. H. Scott,¹ in 1917, described a disease which he called the central neuritis of Jamaica. He described impaired vision and hearing, itching and burning of the eyes, photophobia, inflammatory lesions in the mouth, fissures, and salivation. In 1927, E. Jenner Wright² described a new deficiency disease, the A-B avitaminosis of Sierra Leone. In Jamaica, faulty vision due to optic-nerve lesions has been commonly complained of by adults. Inasmuch as many of these patients have had positive Wassermann or Kahn tests, the condition in some cases has been ascribed by physicians to yaws or syphilis. In 1934, during a post-hurricane period of food shortage, there was an epidemic of cases of nutritional edema and "dark eyes" among children. These came under the care of Drs. L. M. Clark and W. N. Dickenson at the Kingston Public Hospital. The cases responded so

well to cod-liver oil plus a liberal diet that these doctors published an article on this subject in 1936.³ As far as is known, neither of these men was aware of similar diseases in Africa.

As school medical officer of Kingston, I treated several hundred similar cases more or less successfully with a mixture of cod-liver oil and iron plus a diet of protective foods for four years from 1934 to 1938. At that time my attention was drawn to E. Jenner Wright's² article and Fitzgerald Moore's description⁴ of pellagra in West Africa. The substitution of dried brewers yeast for cod-liver oil was effective in nearly all cases, although some cases seemed to require both products for restoration of satisfactory vision (6/6 or 6/9). The view was, therefore, taken that deficiency of no one vitamin was responsible, but that both vitamins A and B were implicated.

ANALYSIS OF THE CASES

The following are observations on 74 cases of retrobulbar neuritis treated at the School Clinic in Kingston during the year 1945.

* School Medical Officer.

Race, Sex, Age. The children were all colored or black. (In Jamaica "colored" means of mixed European and African blood; "black" indicates a more or less pure-blooded African.) Girls outnumbered boys roughly in the ratio of 2 to 1. The youngest child was 9 years of age, the oldest, 16 years; the majority were in the 12- to 13-year-old age-group.

Residence. All the patients, except two, came from urban areas in spite of the fact that rural children are usually more poorly nourished than town dwellers and often show marked signs of vitamin-B deficiency. Angular stomatitis and glossitis were often present, skins were overly dry and exhibited uneven pigmentation. The skin in some cases was also thickened and cracked. Many children appeared to be in fairly good condition, however.

These children came from the poorer social-economic groups in the majority of cases. Children and parents alike were unobservant, often ignorant. In the higher economic groups the visual defect was noted earlier.

Symptoms. A history is usually difficult to obtain. Unless discovered by routine school examination, cases are not usually seen until far advanced, at which time vision is 6/24 to 6/60, or less. The children make no complaints other than "dark eyes," not being able to see the blackboard, or print running together. They seldom give any account of the time of onset of special symptoms. The patients never complain of pain but occasionally mention photophobia.

There may be signs of general malnutrition, or there may be nothing but over-red lips, particularly noticeable with dark skins. Pèrleche and varying degrees of glossitis may be present. Occasionally the muco-cutaneous junctions of the eyes and nostrils are affected.

Deafness is the most serious concomitant sign. This condition was very evident

in 10 cases and could, no doubt, have been found in more if tests had been made. In contradistinction to Scott's¹ cases of peripheral neuritis there was only one case of ataxia and no complaints of sensory changes.

Visual Examination. The ocular and palpebral conjunctivas are sometimes congested, but usually appear normal. Pupillary reactions are usually slow. Vision varies from 6/9 (J2) to 2/60 (J14). The refraction is usually emmetropic or slightly hypermetropic. In the 74 cases reviewed here, no case exceeded a +2.50 in hypermetropia, and there were only three myopes. This illustrates the low incidence of refractive errors among school children in Kingston.

Dr. Frank D. Carroll demonstrated central scotomas in numerous cases he tested on his visit to Jamaica (see page 172). Color vision is impaired in many cases. This can be found only on testing, for patients never complain of this. The fundi may show no changes in the early stages. Later, however, temporal pallor of the disc develops which may persist even when vision has been restored to normal.

Treatment. Due to war conditions, it was not possible to carry out a standard treatment. Some cases were treated with brewers yeast (6 dr. to 1 oz., daily) and a mixture of cod-liver oil (2 dr. with 15 drops tincture of ferri perchlor). One third of this dose was taken three times a day. The yeast had been kept in sealed tins for two years, but was apparently efficacious in most cases. When this supply was exhausted, a small stock of food yeast made by Colonial Yeast, Ltd. was made available. This did not seem to be as effective as brewers yeast. Finally, trade preparations of the vitamin-B complex (Be Forte) were purchased. Parents were encouraged to add one-half pint of milk, one egg, and vegetables to the daily diet. A few cases received thiamine (5 gr.,

three times a day) or riboflavin alone, but no satisfactory conclusion could be drawn from these.

Results. Fifty patients made satisfactory progress (19 boys, 31 girls). Of these, 26 recovered 6/9 to 6/6 vision; 19 were improved with vision from 6/12 to 6/24. In one case, vision in the right eye was improved to 6/6, while that in the left eye remained at 6/36. Of the remaining 24 patients, three attended the eye clinic only twice. One patient who had visited the clinic five years previously had vision of 6/60 and optic atrophy. The other patients came under treatment late in the course of the disease or attended the clinic irregularly.

Prognosis. How much of the success of the treatment was due to the general increase in diet cannot be estimated. Milk and eggs were ordered for daily use, but it is almost certain that 75 per cent of the children received very little or none at all of these foods. Those cases in which the general diet could be improved were cured rapidly, provided an early diagnosis had been made; that is, while vision was 6/12 or better. The time taken for restoration of normal vision varies from two months to a year or more depending, it would seem, largely on the general improvement

of the diet and, of course, on the severity of the lesion.

The associated deafness was improved in 5 out of 10 cases. The worst cases made no progress in either sight or hearing, even though their general condition became normal. It was noticed that improvement first began in the general condition, particularly in the mouth lesions. The over-red lips and glossitis were always a sign that eye symptoms still persisted. Many patients had healed oral lesions, although vision remained poor.

Cheilitis and glossitis are common among the poorer classes at all times. Under war and hurricane conditions, they are present even among the better economic classes, particularly from January to April each year. The association of cheilitis and glossitis with retrobulbar neuritis was noted by the writer eight years ago. The lips are an indication of the progress of healing. No case with impaired vision has been cured without the oral lesions being healed. In long standing cases, vision sometimes does not improve although the oral lesions are cured rather easily. The general health will usually return. Sight and hearing will not return, however, unless the patient is promptly treated.

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NUTRITIONAL RETROBULBAR NEURITIS*

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A distinct type of retrobulbar neuritis in children has been observed in Jamaica, British West Indies, for many years. A few months ago while in Jamaica I had the opportunity, through the courtesy of Dr. Dahlia Whitbourne of Kingston, to examine numerous children with this condition. Since that time I have had one patient with this disease in New York.

In 1936, L. M. Clark of Jamaica reported¹ on this condition. He found that this type of retrobulbar neuritis occurred most commonly between the ages of 8 to 14 years in malnourished children who frequently had rhagades of the lips. He stated that usually the parents or teachers noticed that the child was not seeing well; on examination it was impossible to improve the vision with glasses. Syphilis and foci of infection could be excluded as etiologic factors. Early in the disease, the optic discs appeared normal but later temporal pallor often developed. Since peripheral neuritis due to malnutrition in adults was well-recognized, and since these children showed other evidence of faulty diet, Clark treated his cases with cod-liver oil plus a good diet containing milk, eggs, and vegetables. These foods are excellent sources of natural vitamin-B complex. The average length of treatment for patients with 20/200 vision was 4½ months. Recurrences occurred in some patients who discontinued their treatment. Patients over 16 years of age were not common, and they did not respond well to treatment—possibly, he states, because atrophic changes had already taken place.

Dr. Whitbourne of Kingston, Jamaica,

has seen 1,069 patients with this condition in the past 12 years.² In 1945, she treated 74 such children. Through her coöperation many of these young patients came to the Kingston Eye Clinic for examination by Dr. Raynold N. Berke and me in February, 1946. Most of them had improved to a considerable extent on her treatment. Some of these had normal vision and no evidence of malnutrition. Examination of the more recent cases presented the following findings.

EXAMINATION OF CASES

Visual Acuity varied from 20/40 to 20/200. It was usually 20/70 to 20/200 when the patient was first seen in the eye clinic. The discs were normal in appearance early in the disease but later often showed marked temporal pallor. Pallor was sometimes seen in children who had made a complete recovery; that is, those whose vision had returned to 20/20 and who had no visual field defects.

Visual Fields which were satisfactory were difficult to obtain in many of the children because of their age. However, in 6 out of 12 older children tested, I was able to obtain definite central or centro-caecal scotomas. These scotomas were usually small. They were usually about 5° in diameter for a 1 mm. white test object at one meter. It was easier to demonstrate the scotoma with a 3 or 5 mm. red test object at one meter than with the smallest white objects. The peripheral field was normal.

Hearing. Approximately 10 percent of the children with retrobulbar neuritis had partial eighth-nerve deafness.

Other Evidence of Dietary Deficiency. Dr. Whitbourne³ states that all the children in her group showed skin or mucous-

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membrane changes considered characteristic of vitamin-B-complex deficiency. These consisted of excoriations at the angles of the mouth and occasionally at the outer canthi, greasy desquamations along the nasolabial folds, sore mouths, and sore tongues. One or all of these signs might be present. No gross neurologic signs were noticed except those of the second and eighth nerves.

Prognosis. Of 72 patients treated 42, or 58 percent, were cured or markedly

prove the diet of the child. The English government has started a campaign to grow a special yeast in Jamaica. This is expected to decrease the number of patients showing evidence of vitamin-B-complex deficiency.

A CASE REPORT

G. O., a man aged 24 years, was seen in New York in March, 1946. He had lived in Jamaica all of his life. At the age of 11 years, blurred vision and decreased

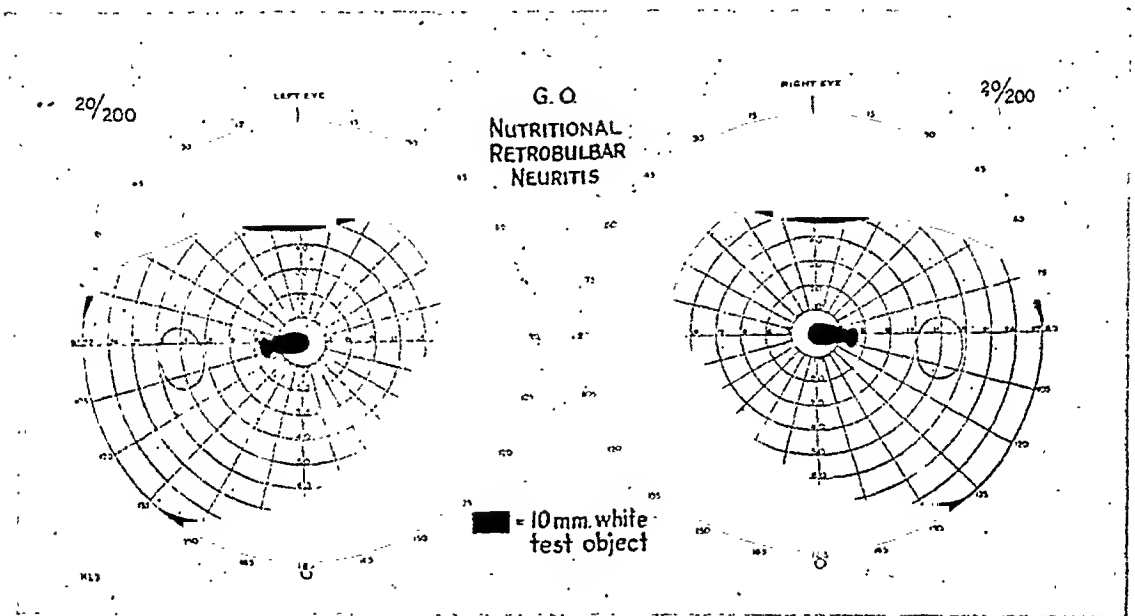


Fig. 1 (Carroll). Visual fields in the case of G. O. show dense centrocaecal scotomas and normal peripheral fields.

improved. The remainder improved slightly or not at all. If a good diet is not continued, the condition may recur. Clark reported one patient who had three attacks over a period of five years. The first time vision improved under treatment from 20/200 to 20/20. Thirty months later, vision improved from 20/200 to 20/40. Two and one-half years later, vision was 20/120 and failed to improve.

Treatment. At the present time, brewers yeast is the treatment of choice in Kingston. Every effort is made to im-

prove the diet of the child. The English government has started a campaign to grow a special yeast in Jamaica. This is expected to decrease the number of patients showing evidence of vitamin-B-complex deficiency.

hearing were noticed. He was seen by the leading ophthalmologists in Kingston, but no improvement had resulted. He recalled taking cod-liver oil but stated that his condition had remained stationary for the past 13 years. Examination showed vision to be 20/200 in both eyes, unimproved. Fundus examination showed marked temporal pallor in both eyes; otherwise, the fundi appeared normal. Visual fields (fig. 1) showed dense centrocaecal scotomas and normal peripheral fields. Kline and Wassermann blood tests were negative. Skin

and mucous membranes were not unusual, and the patient now seemed well nourished. There was no family history of eye disease. Hearing tests were performed by Dr. Edmund P. Fowler, Jr., who reported "a peculiar type of nerve deafness with the greatest loss (by the audiogram test) at a frequency of 1,000" (fig. 2).

COMMENT

The retrobulbar neuritis found in the children of Jamacia resembles very close-

dry beriberi with shooting pains in their feet and legs; still others had wet beriberi with marked edema. It was usually at this time that decreased vision was noticed—a condition which usually came on gradually. If the prisoner's diet was improved, the vision often improved, but most of the men were on a cruelly inadequate diet for several years. The visual acuity of the patients I examined ranged from 20/70 to 20/200; the discs showed definite pallor temporally in some; in

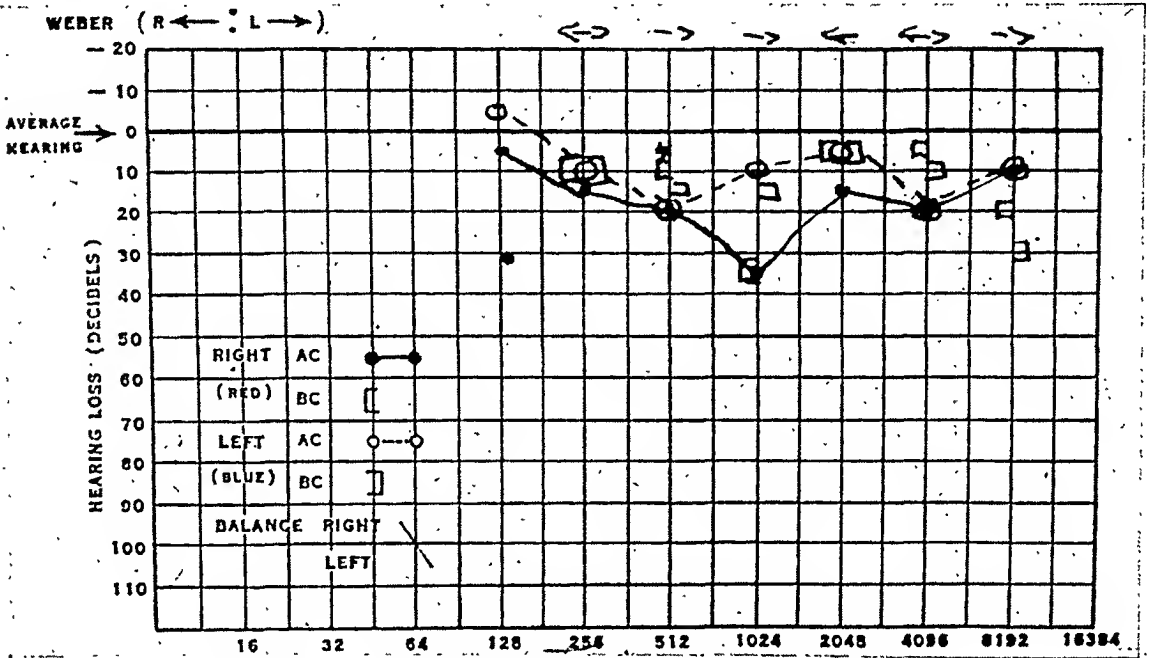


Fig. 2 (Carroll). Chart of the audiogram test in the case of G. O.

ly that seen among American soldiers released from Japanese prisoner-of-war camps. Through the courtesy of the Eye Department at the Valley Forge Hospital, I had the opportunity, in December, 1945, of examining some of these young men. Most of them had been taken prisoner by the Japanese at Bataan or Corregidor in the Spring of 1942. They were given very little food of any kind and within 2 to 3 months most of them developed multiple deficiency diseases. Some described typical skin and mucous-membrane lesions of pellagra; others had

others, the pallor was slight. Peripheral fields were normal. A small pericentral or centrocaecal scotoma was always present. The densest part of the scotoma seemed to be at the center rather than between the blind spot and the point of fixation as in tobacco-alcohol amblyopia.

A typical history is that of an American soldier captured in May, 1942. He was starved from the time of capture. In two months his vision began to decrease; in four months his vision was very poor, and he had dry beriberi, dermatitis, and stomatitis. His diet was then improved

slightly which brought a slight improvement in his vision. He said that for the past year he had noticed no change in his vision. Vision was 20/70, O.U. Visual fields were as illustrated (fig. 3), and the discs showed slight pallor temporally.

T. N., a clergyman, was seen by me in May, 1946, through the courtesy of Dr. James Regan of Boston. The patient's story emphasizes how a deficiency disease

scotomas could be plotted. This patient said that, out of 110 prisoners in his group, 12 had had similar symptoms.

Ridley in a very instructive article⁴ describes small, sharply demarcated central scotomas in 90 released prisoners of war. He states: "Quite a high proportion of the amblyopic have become nerve deaf though other neurological disorders have so far seldom been found." This, of

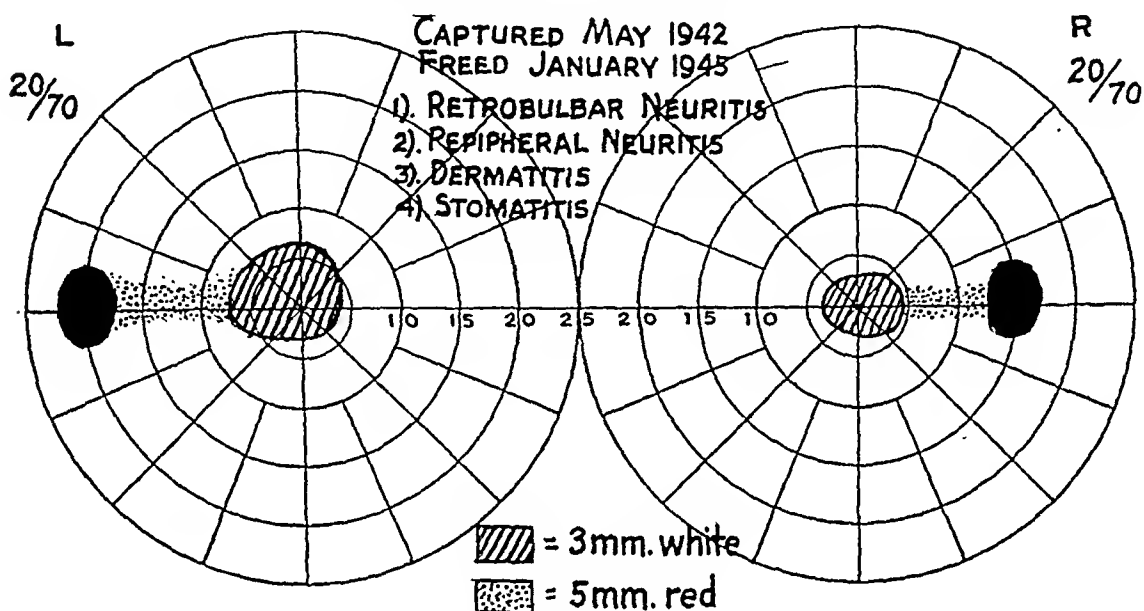


Fig. 3 (Carroll). Visual fields of an American soldier captured by the Japanese in May, 1942.

may be precipitated by intercurrent infections.⁴ During the first two years of imprisonment, after his capture in Burma by the Japanese, the clergyman's general health and vision remained fairly good. However, his diet was poor and his weight decreased from 190 to 175 pounds. In December, 1944, he developed amebic dysentery and in the next three months his weight decreased from 175 to 90 pounds. His vision decreased markedly during this period. His legs became swollen and numb. Beriberi was present. His general condition has improved markedly since his liberation in 1945, but his vision (O.U., 20/200, unimproved), he feels, has not improved. Both discs show marked temporal pallor, and small central

course, is similar to the finding in Jamaica. Ridley attributes the lesion to general malnutrition rather than to simple deficiency of the vitamin-B groups. Reports of other workers⁸ are similar.

Kronfeld⁵ described a type of retrobulbar neuritis in China. This occurred in young adults on very poor diets and was characterized by small central scotomas of about 2 to 3 degrees in diameter. Many cases of nutritional retrobulbar neuritis have been reported from West Africa⁶ and the Orient.⁷

In considering the etiology of this Jamaican retrobulbar neuritis, we have to decide whether or not it is nutritional in origin and, if so, what essential food elements are lacking. Serologic tests exclude

syphilis as a cause. The possibility that this condition is hereditary has been taken into account, but no family history of similar eye disease is obtainable. Recovery seems to depend on improvement in the patient's diet, or at least adding yeast to the diet he was receiving while the optic-nerve disease was developing. Yeast contains all the vitamin-B fractions, and it is possible that the fraction which is responsible for curing the skin and mucous-membrane lesions may be different from that which favors recovery of the optic nerve.

SUMMARY

Nutritional retrobulbar neuritis has been studied in children in Jamaica. The condition appears to be similar to the syndrome found in numerous released prisoners of war. Although it seems certain that the disease is nutritional in origin, these patients were on diets deficient in many essentials. It is, therefore, impossible in the light of our present knowledge to be sure which factors produced the loss of vision.

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A CASE OF A SPLINTER OF GLASS IN THE ANTERIOR CHAMBER OF FOUR YEARS' DURATION

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Probably the most difficult intraocular foreign body to remove from the eye is glass. This difficulty is due, first, to the fact that most glass does not show up in X-ray studies and cannot be localized. Secondly, the operator in the majority of cases is dealing with a very small splinter of glass which, in order to remove, must require operating with a high-powered loupe and very brilliant illumination. In the third place, particles of glass are always jagged, are hard to grasp, and their irregular contour causes them to adhere to the surrounding structures. In attempting to remove them a pair of duck-billed forceps is the best instrument to use. Fourthly, glass is nonmagnetic, and its removal from the anterior chamber depends upon two methods: (1) opening the anterior chamber and mechanically picking the foreign body from it; (2) making an incision into the anterior chamber with the patient facing and looking downward which causes the ensuing gush of aqueous to expel the material.

REPORTS IN THE LITERATURE

In looking over the literature, I found a number of cases which were very interesting. During a meeting of the Royal Society of Medicine, Section of Ophthalmology,¹ Mr. Victor Purvis presented a woman, aged 54 years, with a piece of glass in the anterior chamber. An attempt was made to remove it, but there was a certain amount of wedging between the lens and the cornea. He then tried to do an iridectomy but the glass prevented him from getting an effective hold of the iris. With the slitlamp, a movement of soft lens matter was visible under the capsule of the lens which led to the assumption

that the case was becoming morgagnian. Mr. Purvis stated that he could not remember having seen such mobility before.

During the same meeting,¹ Mr. Frank Juler referred to a case in which he had removed a splinter of glass which was free in the anterior chamber. He had made an incision as for Saemisch's section, with the patient facing and looking downward; the ensuing aqueous drip carried the splinter into the section, where it was easily picked out after the patient had resumed the usual position on his back. In a similar case, he made a puncture with a broad needle in the usual position. The patient was then turned over so that he looked downward; a touch on the cornea released the aqueous, and the foreign body was recovered from the lower fornix.

Dr. John Marshall suggested that, in cases of nonmagnetic foreign bodies in the anterior chamber, a section downward, such as Dr. Traquair employed in his intracapsular extractions, gave a good approach to the angle of the anterior chamber. A stitch was placed in the conjunctival flap and the cornea turned upward so that the major portion of the iris was exposed, and the foreign body was easily removed by blunt forceps.

Azarova² reported two cases of glass in the eye which occurred during air raids. The glass remained in the eye for long periods. He states that glass is difficult to locate with the X ray; that it can remain in the eye for a long time without producing inflammatory phenomena; that, if left alone, it appears to be well tolerated by the eye; that the eyeball tends to extrude the foreign body, often spontaneously, after remaining in

the eyeball for a long time. He reports two cases. In the first, a particle of glass lodged in the pars planum of the ciliary body in the left eye of a civilian during an air raid. The patient developed an iridocyclitis. He was under treatment for 10 weeks during which time an unsuccessful attempt was made to remove the foreign body. After recurring attacks of irritation complicated by papillitis, the eye became quiet and remained so for the year it was under observation. There was a retinal detachment and particles of glass could be seen in the vitreous. The second case was also of an injury sustained during an air raid. The patient was found to have a retinal detachment and the X ray revealed a small intraocular foreign body with a large piece of glass in the antrum. The eye, although blind, remained quiet for 15 months, at the end of which time a particle of glass was spontaneously extruded from the original wound. Within the next three days the eyeball was lost from panophthalmitis, in spite of the vigorous use of sulfonamides.

CASE REPORT

P. McG., aged 17 years, was, on August 19, 1942, experimenting in a laboratory in the home of a friend when an explosion took place while they were working on glass and steel. The explosion was quite severe, blowing off the arm of one of the experimentors and seriously wounding three or four others. They had obtained a mixture of potassium nitrate, red phosphorus, sulphur, and charcoal, and these ingredients were placed in a mayonnaise jar. After it had been stirred three or four times, the mixture exploded. The injured were removed to a hospital, and it was found necessary to enucleate the right eye of my patient. This patient states that the left eye did not annoy him at the time of the enucleation, but about 1½ years after the removal of the right eye,

he noticed a diminution of vision in the left eye which gradually became worse, with very slight pain. He experienced marked photophobia and lacrimation. An X-ray picture was taken at the time of the accident, but no intraocular foreign body was found. The X-ray picture of his teeth was negative, and a complete laboratory examination was also negative.

We first saw this patient on August 8, 1945, at which time the eye presented the following condition. Vision in the left eye was 20/40 and could not be improved. The cornea presented a large vascularized infiltration which covered its lower half and was a textbook picture of a bullous keratitis. The upper part of the cornea was slightly hazy, and the vitreous and fundus, which could not be clearly seen, appeared normal. Principal medication had been atropine, and dark glasses were worn when the eye presented symptoms of irritation. The patient also had been taking large quantities of vitamins. This treatment had been prescribed for a period of over four years. He had consulted a number of ophthalmologists but no evidences of intraocular foreign material could be definitely made out. He had no atropine conjunctivitis. I suggested the use of homatropine. Perhaps, shocking the iris in this way without causing so much dilatation of the pupil would help to alleviate the marked symptoms of irritation which the eye presented. He stated, however, that his eye felt better when using atropine. When not under the influence of atropine, the pupil reacted well to light and accommodation. There were no synechiae and no deposits on the anterior capsule of the lens. He was immediately referred to Dr. Irving Schwartz of the X-ray Department of the New York Eye and Ear Infirmary for a radiographic examination of the left eye for a possible intracular foreign body of glass or steel. The report is as follows:

"There are several small foreign bodies in the vicinity of the left orbit. The density of the shadows they cast corresponds to glass. There is no evidence (X ray) that any of these foreign bodies are in the globe."

An examination with the slitlamp two or three times a week was always negative for any foreign material. The examination was somewhat difficult due to the intense photophobia and the lacrimation which was always increased when the eye was subjected to strong light. A few drops of a 2-percent solution of holocaine instilled into the eye greatly facilitated the examination.

On December 12, 1945, while studying the whole anterior chamber, I was positive that I saw a piece of glass in the angle of the anterior chamber around the 4-o'clock position. It had the appearance of a yellowish prismatic crystal about $2\frac{1}{2}$ mm. wide and about 5 mm. long. The drawing (fig. 1) gives a good idea of how the foreign body appeared. Three days later, Dr. John Dunnington of the Institute of Ophthalmology of the Presbyterian Hospital confirmed my diagnosis, and I decided to remove the glass. The case was also shown to Dr. Wendell L. Hughes at the New York Eye and Ear Infirmary. Dr. Pfeiffer of the Institute of Ophthalmology, of the Presbyterian Hospital very kindly made X-ray studies of the orbits of my patient with the following report:

"Films of the orbits in the Caldwell position reveal many fragments in the tissues of the face and lids of the right eye. One fragment measuring approximately 2×3 mm. of glass density can be seen in the left orbit and would appear to be in the eye. Bone-free films which include approximately 16 mm. of the anterior segment of the left eye show a number of particles in the lower lid and

none definitely within the eye itself."

A second X-ray study made by Dr. Pfeiffer is as follows:

"The faint shadow of glass density previously noted in the left orbit is localized outside of the eyeball with the contact lens."

OPERATIVE PROCEDURES

The glass could not be seen with the naked eye, but with a small hand slitlamp

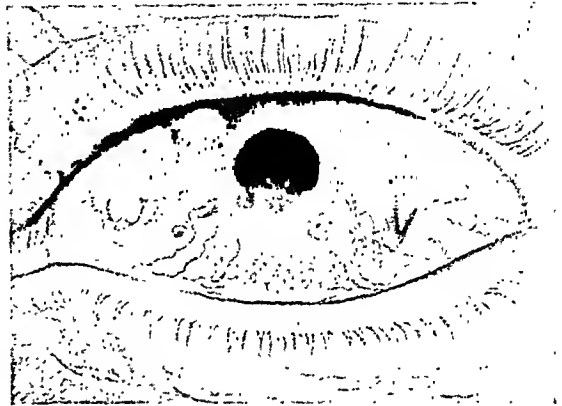


Fig. 1 (Doherty). Bullous keratitis with glass near the angle of the anterior chamber between the 3- and 4-o'clock positions.

and a good Zeiss loupe there was definitely no question regarding the cause of this patient's discomfort over a period of years (four). He entered the New York Eye and Ear Infirmary, and I attempted to remove the foreign body. It appeared in close apposition with the posterior surface of the cornea, and my idea was to make an incision at the limbus with a keratome, posterior to the glass at its lower border or spear-shaped edge, the point of the keratome coming to the edge of the lower part of the glass. It was then my intention to enlarge the incision upward with a pair of Stevens' scissors long enough to grasp the foreign body and extract it with a pair of duck-billed forceps.

My source of illumination was the ordinary eye-operating lamp, such as is used for any intraocular operation, and

to get better concentration of the light, I used a hand condensing lens. This mode of illumination proved very faulty, as it was impossible to get a good view of the glass in the anterior chamber. My troubles

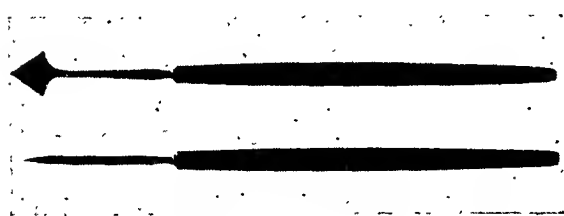


Fig. 2 (Doherty). Black-stained cataract knife and keratome which do not cast dazzling reflections.

were augmented by irregular reflections from the keratome and speculum. In this type of case, a hand slitlamp should be used. In making my incision the dazzling from the keratome obliterated the foreign body no matter from what angle I viewed it. In endeavoring to change the position of the keratome very slightly, the anterior chamber was lost with a gush of aqueous but no prolapse of the iris. I examined the site of the foreign body for some time but could not see it. Finally, I introduced a long olive-shaped spoon into the anterior chamber and attempted to scoop out the foreign body, although I was unable to see any evidences of it. Atropine was instilled into the eye and a dressing was applied. Healing was uneventful.

I continued to examine the eye two or three times a week with a slitlamp but could not find any evidences of the foreign body. In April, 1946, because of the bullous keratitis, I advised the patient to stay indoors; to use penicillin ointment with a patch three times a day for one hour at a time. From then on, there has been a gradual improvement until at this writing, July 27, 1946, the eye is quiet. There is no circumcorneal injection, no photophobia, and only slight lacrimation

when examined with strong light. Bullous keratitis has completely disappeared, and the opacity is a faint macula over the lower border of the cornea which is still clearing. The pupillary area is clear. Vision under homatropine is: 20/15 with a +0.50D. sph. \ominus +0.50D. cyl. ax. 75°. The pupil reacts well to light and accommodation. There are no opacities on the anterior capsule of the lens, and the media and fundus are normal. Small pieces of glass are being extruded spontaneously from the upper and lower lids of both eyes at the present time.

CONCLUSIONS

This case was very interesting and instructive.

1. I am positive that in similar cases the hand slitlamp is the best source of illumination.

2. The eye speculum and keratome should have a dull or black finish to prevent dazzling. I presented my ideas to Victor Mueller of Chicago, and Mr. George M. Wallerich, president of the company, had two cataract knives and two keratomes made with a black nickel or acid finish (fig. 2). I have used these instruments, and it is my opinion that they will supplant the highly polished instruments that are now in vogue. I have asked many of my colleagues and they say that the idea is excellent. Dazzling and reflections from highly polished instruments have annoyed them too. If one does not wish a black finish, a dull-satin finish is preferable to the highly polished one. For the ophthalmologist, the black-finished speculum and black-finished cataract knife and keratome can be used with more precision because they are nonreflecting and because of their contrast with the cornea.

I wish to thank Drs. Dunnington, Pfeiffer, Hughes, and Schwartz for their interest in this case, and also to thank

Miss Mary R. Brown and Miss Margaret Markham of the photographic department of the New York Eye and Ear Infirmary for their painstaking efforts in obtaining a photograph of the glass after many exposures taken at different angles. I wish

also to express my appreciation to the men of the Peter Junco photographic studio, New York, for their excellent photograph of the dark-stained instruments.

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PERSONALITY PATTERNS OF WHITE ADULTS WITH PRIMARY GLAUCOMA*

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In recent years there has been an increasing emphasis on the study of psychosomatic medicine. Physicians, psychiatrists, and social workers have explored the emotional components of various illnesses, and in some of the diagnostic groups personality patterns have emerged.¹ Very little research has been done in the psychic factors of ophthalmic disorders. No previous studies have been made, to my knowledge, to determine if there is a personality pattern common to these patients. However, rather conclusive evidence has been found to support the thesis that emotional factors play a prominent role in the treatment of many patients suffering from glaucoma.

A selected group of 27 glaucoma patients was examined to ascertain: first, whether patients with primary glaucoma exhibit greater personality disturbance as

measured by a personality inventory than would the normative group for that inventory; and second, whether a demonstrable variation of personality patterns could be shown to exist when the patients were classified according to various social and medical data. The ultimate purpose in obtaining this information was to enable ophthalmologists and social workers to give glaucoma patients more effective treatment.

Because of the seriousness of the disease, if untreated, and the emotional factors involved, an agreement was made several years ago between the ophthalmic and the social-service staffs of Washington University clinics that all patients with the diagnosis of glaucoma would be referred to a social worker for social investigation and social therapy. Names of these patients and various identifying information are kept in a case-holding file from the time the diagnosis of glaucoma is made. The active file on October 1, 1945, listed 154 patients. The 27 patients

* Summarized from a dissertation presented to the George Warren Brown School of Social Work of Washington University in partial fulfillment of the requirements for the degree of Master of Social Work, June, 1946.

participating in this study were drawn from this number.

Several qualifications governed the choice of this group. Only those patients diagnosed as having primary glaucoma were studied. Since the personality inventory selected was standardized for white patients, a second limitation was made by including only white persons. A third limitation permitted the inclusion only of those patients who were currently attending the glaucoma clinic of Washington University Eye Clinic.

Of the 154 patients in the active file on October 1, 1945, 60 were Negro and 94 were white. Of the white group, 20 were diagnosed as congenital or secondary glaucoma, and 74 as primary glaucoma. Examination of these 74 patients was planned, but 47 had to be excluded for reasons ranging from geographical inaccessibility to diagnosed mental illness.

THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY

The Minnesota Multiphasic Personality Inventory² was the instrument selected through the assistance of Dr. C. F. Jacobsen, medical psychologist and assistant dean of the Washington University Medical School.* Published originally in 1942, the inventory was devised by Dr. S. R. Hathaway, associate professor of psychology, and Dr. J. C. McKinley, professor of neuropsychiatry at the University of Minnesota, to indicate marked deviations from normal personality trends. The booklet form was used, containing 566 questions arranged in such a way that all the answers could be recorded on a single International Business Machines scoring sheet. The first 366 items were used, because scoring keys and norm tables have been developed only for this number. The subject is asked to reply

"true," "false," or to make no reply if it is something which he does not know about or which does not apply to him.

It consists of three validating scales and nine scales to measure personality trends. Of the validating scales, the Question Score (?) indicates the number of unanswered items; the Lie Score (L) measures the degree to which the subject may be attempting to falsify his scores by always choosing the response that places him in the most acceptable light socially; and the Validity Score (F) indicates the rationality and pertinency of the subject's responses.

The Hypochondriasis Scale (Hs) is a measure of the amount of abnormal concern about bodily functions. It is characteristic of the hypochondriac that he is immature in his approach to adult problems, tending to fail to respond with adequate insight.

The Depression Scale (D) measures the depth of the clinically recognized symptom or symptom complex, depression. The depression may be the chief disability of the subject or it may accompany, or be a result of, other personality problems. A high D score indicates poor morale of the emotional type with a feeling of uselessness and inability to assume a normal optimism with regard to the future. It further suggests a characteristic personality background in that the person who reacts to stress with depression is characterized by lack of self-confidence, tendency to worry, narrowness of interests, and introversion.

The Hysteria Scale (Hy) measures the degree to which the subject is like patients who have developed conversion-type hysteria symptoms. Definite symptoms may never appear in a person with a high score, but under stress he is likely to become overtly hysterical and attempt to solve the problems confronting him by the development of symptoms.

* Dr. Jacobsen is now dean of the Graduate School, University of Iowa.

These cases are more immature psychologically than those in any other group. The subject with a high Hy score may have a real physical pathologic condition, either as a primary result of concurrent disease, such a diabetes or cancer, or as a secondary result of the long time presence of the psychologic symptoms.

The Psychopathic Deviate Scale (Pd) measures the similarity of the subject to a group of persons whose main difficulty lies in their absence of deep emotional response, their inability to profit from experience, and their disregard of social mores.

The Interest Scale (Mf) measures the tendency toward masculinity or femininity of interest pattern; a high score indicates a deviation of the basic interest pattern in the direction of the opposite sex.

The Paranoia Scale (Pa) was derived by contrasting normal persons with a group of clinic patients who were characterized by suspiciousness, oversensitivity, and delusions of persecution, with or without expansive egotism.

The Psychasthenia Scale (Pt) measured the similarity of the subject to the psychiatric patients who are troubled by phobias or compulsive behavior. Frequently a psychasthenic tendency may be manifested merely in a mild depression, excessive worry, lack of confidence, or inability to concentrate.

The Schizophrenia Scale (Sc) measures the similarity of the subject's responses to those patients who are characterized by bizarre and unusual thoughts or behavior. There is a splitting of the subjective life of the schizophrenic person from reality so that the observer cannot follow rationally the shifts in mood or behavior.

The Hypomania Scale (Ma) measures the personality factor characteristic of persons with marked overproductivity in

thought and action. The hypomanic patient has usually gotten into trouble because of undertaking too many things. His activities may interfere with other people through his attempts to reform social practice, his enthusiastic stirring up of projects in which he then may lose interest, or his disregard of social conventions.

It was necessary to read the items to all but six of the patients studied. The results indicated that this variation from the proscribed procedure for administering the inventory did not affect the validity.

The standard-score equivalents of the raw scores were obtained from prepared tables and placed on profile charts for each patient. The patients were then classified according to various social and medical data, and their scores analyzed for similarities or differences.

ANALYSIS OF DATA

The most important finding of the study was that more than two thirds of the patients showed marked deviations on one or more of the personality scales. This concentration of extreme deviating scores is distinctly unusual and stands in sharp contrast to Hathaway's finding that but 5 percent of the original normative group showed such marked deviations, illustrated in Tables 1 and 2. All scores below 60 were considered to be within normal ranges. Scores between 60 and 69 indicated a definite personality trend, while scores 70 and above suggested severe personality disorders.

It is clearly evident that the group of patients with primary glaucoma show severe personality deviation, in many instances with scores suggesting behavior bordering on the psychotic. It is of further interest that four female patients were omitted from the study, one because

she had been admitted to a mental hospital, and three because their personality disturbances and great feeling of persecution, as evidenced by their overt behavior in the clinic and conversations with the

No personality pattern was found to be common to the group as a whole. However the "average" profile for the male group of 15 patients was distinctly different from the "average" profile of the

TABLE 1

DISTRIBUTION OF 15 MALE GLAUCOMA PATIENTS ACCORDING TO INDIVIDUAL SCORES ON THE NINE SCALES COMPARED WITH THE NORMATIVE GROUP

Scale	Percentage of Scores					
	70 and Above		60 to 69		Below 60	
	Glaucoma	Normative*	Glaucoma	Normative	Glaucoma	Normative
Hypochondriasis	46.7	5.8	20.0	10.2	33.3	84.0
Depression	40.0	4.8	40.0	10.2	20.0	85.0
Hysteria	33.3	2.6	26.7	14.6	40.0	82.8
Psychopathic Deviate	13.3	5.4	26.7	13.3	60.0	81.3
Masculinity-Femininity	0.0	0.0	4.5	0.0	95.5	100.0
Paranoia	13.3	4.8	26.7	9.6	60.0	85.6
Psychasthenia	13.3	5.4	13.3	11.9	73.4	82.7
Schizophrenia	13.3	4.8	26.7	9.6	60.0	85.6
Hypomania	13.3	5.1	20.0	15.3	66.7	79.6

* Percentage of scores in the various categories for the male normative group, appearing in a letter from Dr. Hathaway to Miss Schutz, thesis supervisor, School of Social Work, Washington University, January 12, 1946.

TABLE 2

DISTRIBUTION OF 12 FEMALE GLAUCOMA PATIENTS ACCORDING TO INDIVIDUAL SCORES ON THE NINE SCALES, COMPARED WITH THE NORMATIVE GROUP

Scale	Percentage of Scores					
	70 and Above		60 to 69		Below 60	
	Glaucoma	Normative*	Glaucoma	Normative	Glaucoma	Normative
Hypochondriasis	25.0	3.8	41.7	15.6	33.3	80.6
Depression	16.6	3.3	41.7	11.6	41.7	85.1
Hysteria	16.6	4.2	16.7	10.9	66.7	84.9
Psychopathic Deviate	8.3	4.1	41.7	10.6	50.0	85.3
Masculinity-Femininity	33.3	3.8	41.7	9.3	25.0	86.9
Paranoia	50.0	3.0	16.7	9.3	33.3	87.7
Psychasthenia	41.7	4.8	8.3	11.2	50.0	84.0
Schizophrenia	50.0	4.3	8.3	11.2	41.7	84.5
Hypomania	41.7	2.8	0.0	12.1	58.3	84.9

* Percentage of scores in the various categories for the female normative group, appearing in a letter from Dr. Hathaway to Miss Schutz, thesis supervisor, School of Social Work, Washington University, January 12, 1946.

doctors and social workers, were sufficiently severe to render questionable the value, either to them or to the study, of their inclusion. The "average profile," as determined from the mean scores of all the patients on the nine scales is illustrated in Chart 1.

12 female patients, illustrated in Chart 2.

It may be observed that the men had higher scores on the scales Depression and Hysteria; the women had higher scores on the scales Paranoia and Schizophrenia. The statistical probabilities computed for these groupings provide

good basis for further study among glaucoma patients. The personality trends indicated by the inventory were substantiated by all the social information available.

The most significant findings when the patients were classified according to various medical data were on the basis of intraocular pressure. Previous writers have found that increase in intraocular pressure is frequently precipitated by anxiety states.³ The medical records of these 27 patients were studied and divided into the two groups "tension consistently low"

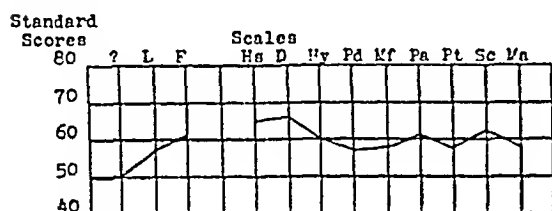


Chart 1 (Hibbeler). Profile chart showing the "average" profile of the glaucoma patients as determined from the mean scores on the 12 scales.

and "other." The first group included all those whose tension, after the first two months of treatment at Washington University Clinics, was never recorded as higher than 25 mm. Hg (Schiotz). "Other" included all those whose tension was higher than 25 mm. one or more times, or remained consistently higher. There was a very noticeable difference between these two groups, as may be seen in Chart 3. Those patients whose tension remained low have higher scores on almost every scale, the most marked difference being in paranoia, where the average score for the "low" group is 14 points higher than for "other." Dr. Hathaway believes this profile is not surprising, for two reasons. First, the more rigid and successful a hysterical symptom, the less evidence has been found for psychologic stress. The successful conversion symp-

tom seems to "drain off" the psychologic stress. The second point of interest is that the dominant pattern tends toward the hysterical-type curve. This, together with depression, is the accepted picture of psychologic stress generally.

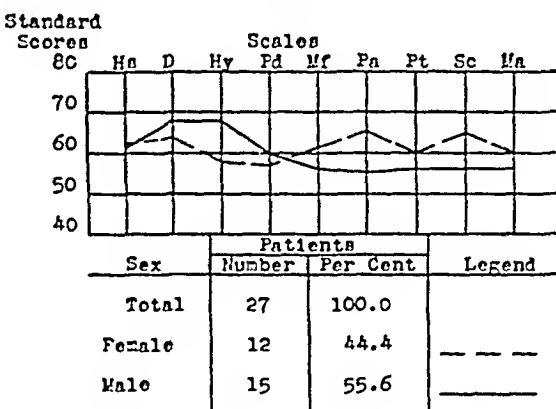


Chart 2 (Hibbeler). Profile chart showing the "average" profiles of glaucoma patients grouped according to sex, as determined from the mean scores of each group on the 12 scales.

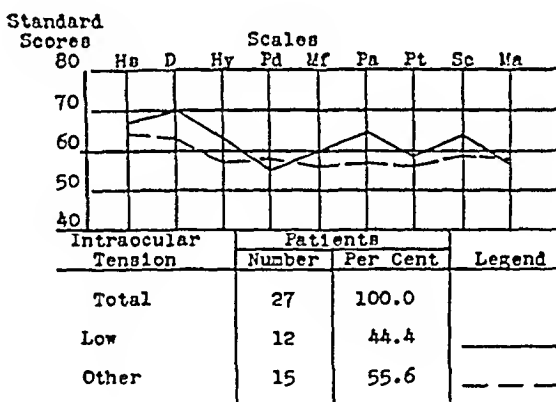


Chart 3 (Hibbeler). Profile chart showing the "average" profiles of glaucoma patients grouped according to response to medical care.

In an attempt to determine the importance of suggestion and identification with a loved person in the choice of site for physical handicap, each patient was asked how many of his relatives had visual disorders. Each one he mentioned in reply was noted, whether it were a refractive error or complete blindness, in the belief that if it were not important to

him, he would not have mentioned it. Approximately one third of the patients reported such relatives, and this group exhibited scores on three scales much higher than those with no relatives with a visual handicap. These average scores were in the psychotic ranges on hypochondriasis

central vision, diagnosis of chronic-simple or acute-congestive glaucoma, or length of time since the diagnosis was made, except in some cases to support the trends for the population as a whole.

CONCLUSIONS

This preliminary survey of patients with primary glaucoma has shown that they exhibit more frequent disturbances of personality as measured by the Minnesota Multiphasic Personality Inventory than do unselected clinic patients. The trend of personality disturbance for the male patients is in the direction of "depression" and "hysteria;" the trend for the female patients is in the direction of "paranoia" and "schizophrenia." The group of patients whose intraocular pressure remains within normal limits with medical treatment have slightly greater probability for marked deviation of scores than the group whose tension is occasionally or always elevated. Statistical analysis provides adequate basis for further study of these trends, which may furnish knowledge valuable in planning medical and social therapy for patients with primary glaucoma.

5330 Pershing Avenue (12).

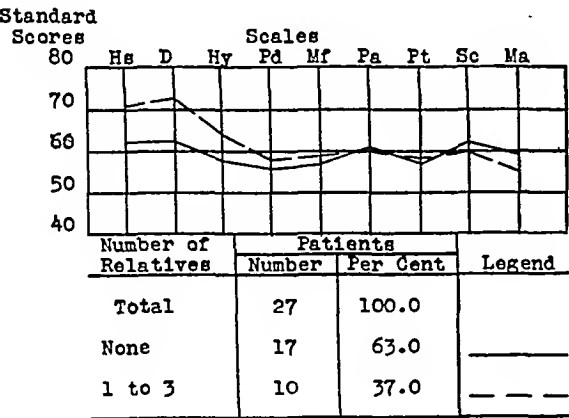


Chart 4 (Hibbeler). Profile chart showing the "average" profiles of glaucoma patients grouped according to number of relatives with a visual disorder.

and depression, as may be seen in Chart 4.

No significant divergences were demonstrated in the other groupings according to age, education, number in family, birth position, marital status, amount of

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SIGNIFICANCE OF ACTION OF PAREDRIENE ON THE OCULAR TENSION OF RABBITS*

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In a former study¹ it was shown that instillation of 1-percent paredrine had no appreciable effect on the ocular tension in most rabbits. The tension was determined 30 minutes or four hours after administration of the drug. Some of the animals showed, however, a definite increase in pressure. This paper deals with those factors which were responsible for the variations obtained in the previous study.

METHODS AND MATERIALS

Nine rabbits were used in the experiment. Five rabbits were New Zealand white, three Flemish giant brown, and one Chinchilla. The ocular tension was determined tonometrically with 5.5 gr. and 10 gr. weights. The average values were obtained from two readings which were made with each set of weights at each recording. The readings were calculated for normals and also 10 to 15 minutes after application of paredrine. A change of 3 mm. Hg or more was regarded as a definite increase in pressure. The paredrine was applied with an applicator to the entire corneal margin. Because of the local application, the action of the paredrine was restricted for a short period to the pericorneal blood vessels. In control experiments 0.5-percent salt solution, 0.1-percent pilocarpine, and 0.05-percent atropine were used. After the tonometric studies were completed, the animals were examined under nembutal

narcosis with a corneal microscope and a slitlamp.

RESULTS

Two of the white rabbits persistently showed an increase in tension with paredrine. Three other white rabbits had an

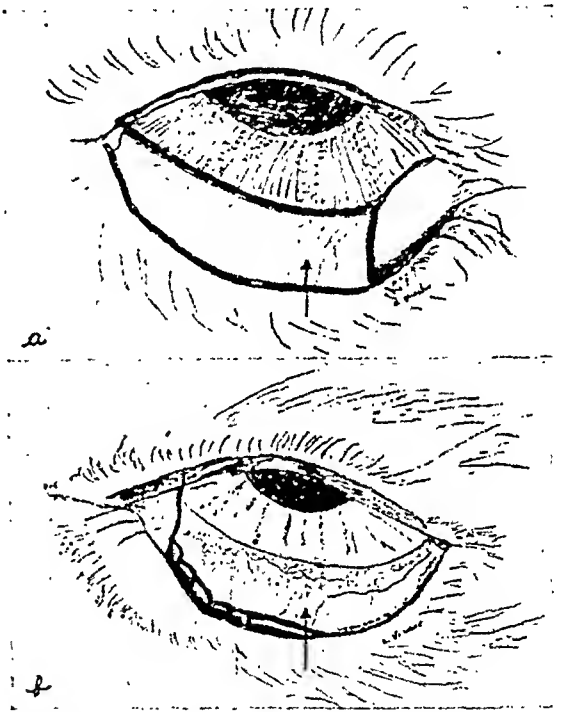


Fig. 1 (Schmerl). Drawings of eyes of two rabbits. a, Chinchilla rabbit with a relatively poor pericorneal vascular bed. b, pericorneal region in a white rabbit with a rich vascular supply. Due to the difference of the degree of vascularity of the pericorneal beds, there was a corresponding quantitative vasoconstriction response. The number of the pericorneal vessels which were constricted resulted in variable intraocular pressures due to varying degrees of interference with drainage of the aqueous.

increased tension in most of the determinations. The colored rabbits showed an increase in 40 percent of the measurements. Examinations with a corneal microscope revealed an extensive peri-

* From Toledo Hospital Institute of Medical Research, Toledo, Ohio. This work was supported by a grant from the Snyder Ophthalmic Foundation.

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corneal vessel bed in the two rabbits with persistently high tension. The remaining three white rabbits showed a definitely smaller vascular bed. The pericorneal vessels in the brown animals were smallest in number. Some of the vessels of one of the brown rabbits failed to contract after repeated applications of paredrine. In the three white rabbits, the extensive pericorneal vascular bed was associated with

aqueous is assumed to depend on the semipermeable activity of the capillary walls and the difference of osmotic pressure. The ciliary body is accepted in this and other concepts as the significant origin of the humor. In the secretion theory, it is assumed that the aqueous is secreted by the epithelium of the ciliary body.

The outflow of the aqueous humor is believed to be controlled by two mecha-

TABLE 1
EFFECT OF PAREDINE ON OCULAR TENSION

Color of Rabbit	Ocular Tension with 5.5 gm. Weight (single readings)				Ocular Tension with 10 gm. Weight (single readings)				Total No. of Measurements	Percentage Increase in Tension
	Before Drug		After Drug		Before Drug		After Drug			
	Right Eye	Left Eye	Right Eye	Left Eye	Right Eye	Left Eye	Right Eye	Left Eye		
White	19 ± 1	20 ± 0	24 ± 1	26 ± 1	18 ± 2	19 ± 0	23 ± 1	25 ± 1	36	100
White	19 ± 0	18 ± 0	26 ± 1	24 ± 1	20 ± 0	19 ± 0	27 ± 2	26 ± 1		
White	21 ± 0	20 ± 0	21 ± 0	24 ± 0	23 ± 1	21 ± 1	24 ± 0	26 ± 0	52	77
White	21 ± 0	21 ± 0	24 ± 1	23 ± 0	20 ± 0	21 ± 1	24 ± 0	26 ± 1		
White	20 ± 1	18 ± 1	24 ± 1	21 ± 0	19 ± 1	17 ± 1	25 ± 1	22 ± 2		
Brown	18 ± 0	16 ± 1	18 ± 0	16 ± 0	16 ± 1	14 ± 0	16 ± 0	15 ± 1	32	40
Brown	20 ± 1	18 ± 1	18 ± 0	19 ± 1	19 ± 1	19 ± 1	16 ± 0	19 ± 1		
Brown	18 ± 1	19 ± 1	20 ± 1	22 ± 1	17 ± 1	19 ± 1	23 ± 1	23 ± 1		
Chinchilla	20 ± 1	16 ± 0	23 ± 2	22 ± 1	20 ± 1	16 ± 0	25 ± 1	23 ± 1		
White	Controls: Readings were taken after application of 0.5% sodium-chloride solution, 0.05% atropine, and 0.1% pilocarpine.								68	12

presence of aqueous veins described by Ascher.²⁻⁴ A rhythmic inflow of a clear watery fluid into veins carrying blood was observed in these animals with a corneal microscope of 29× magnification.

DISCUSSION

There are three concepts regarding the inflow of aqueous humor into the anterior chamber of the eye. In the filtration concept, the ciliary body vessels are accepted as the principal supply of aqueous by virtue of the inequality between the hydrostatic pressure of these vessels and that of the posterior chamber. In the dialysis concept, the circulation of the

nisms, hydrostatic and osmotic forces, with the iris and Schlemm's canal being the principal foci of reabsorption of the humor.

There are considerable data to indicate that the circulation of the aqueous is continuous and proceeds at a rate of 1 to 4 cu. mm. per minute.⁵⁻⁸ Asher supplied morphologic proof of presence of circulation of the aqueous by his discovery of the aqueous veins.²

Intraocular pressure normally approximates 18 to 28 mm. Hg. The pressure depends on the inflow, outflow, and the continuous circulation of the humor. Interference with the outflow of the aqueous or of its circulation, or an increase in the

inflow will result in the elevation of the pressure.

Various drugs have been employed in an effort to clarify the concepts of inflow, outflow, and of the continuous circulation of the aqueous. The action of a drug on the vascular system is either one of vasoconstriction or dilatation. It is maintained that vasoconstriction outside of the eye produces an increase in the ocular tension due to a concomitant vasodilatation of the vessels within the eyeball.⁹ The pericorneal and episcleral vessels must be considered as outside the eyeball. Contraction of the intraocular vessels results in a drop of intraocular pressure. In the instance of adrenalin, it was found that the route of administration may produce varying actions. When injected intravenously or into the subconjunctiva, there is a decrease, sometimes preceded by a slight increase,¹⁰ in the intraocular pressure.¹¹⁻¹⁴

In these experiments, paredrine was used. Its action is similar to that of adrenalin. Application of the drug to the pericorneal vessels along the entire margin produced a constriction of these vessels followed by an increase in the intraocular pressure. The relative vascularity of the pericorneal region apparently determined the frequency with which the animals responded to application of the

drug by an increase in ocular tension.

These experiments suggest that there is a continuous circulation and that the outflow of the aqueous occurs in part through Schlemm's canal into the pericorneal vessels. It may also be inferred from these experiments that the circulation of the aqueous is controlled by hydrostatic pressure as one of the forces.

SUMMARY AND CONCLUSION

Paredrine was applied locally to the pericorneal vessels of the eye. There was a resultant increase in the intraocular pressure which was dependent on the extensiveness of the vascular bed in the pericorneal region. Paredrine produced a local vasoconstriction. The rise of intraocular pressure paralleled the quantity of the pericorneal vessels which were constricted by the local application of paredrine. The vasoconstriction interfered with drainage of the aqueous. These experiments suggest the presence of a continuous circulation of the aqueous and the influence of hydrostatic pressure as one of the forces in circulation of the humor. There is also an indication of the importance of Schlemm's canal as one of the outlets of the aqueous.

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SOME METHODS OF LID REPAIR AND RECONSTRUCTION*

III. SOCKET RECONSTRUCTION WITH EPIDERMIS

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The ideal lining for a socket is mucous membrane. Where a slight deficiency exists, readjustment of tissues by means of a V-Y or Z plasty may be all that is necessary. Occasionally, small conjunctival grafts from the normal fellow eye may suffice. If larger grafts are needed, buccal mucous membrane (labial, or malar, or both) may be used. However, when more than half the socket has been obliterated, one must resort either to multiple mucous-membrane grafts or to an epidermic graft. I prefer the latter and, this report is limited to a discussion of the use of epidermis in eyeless sockets which require large grafts.

In 1921, Wheeler¹ presented an excellent method for total or subtotal reconstruction of an obliterated socket with epidermis. Briefly, the technique consists of dissecting the lids away from the orbital contents. The dissection is carried down below the lower orbital rim to the periosteum, behind the canthi, laterally, and behind the orbital rim above. A form, or stent, of dental compound is molded

to fit the socket. An epidermic graft is then taken, preferably from the upper outer aspect of the thigh, wrapped around the stent, epithelial side inward, placed in the socket, and a firm pressure dressing is applied. This method is as good today as it was 25 years ago.

After using this method for some time, I noticed that the stents tended to be the same shape and in most cases, approximately the same size; that is, about 40 by 30 by 4 mm. It seemed obvious, then, that if an acrylic form of the proper size and shape were available, it would do away with the awkward, time-consuming, dental-molding-compound technique. Accordingly, a series of these acrylic forms in graduated sizes was made up by our plastic eye laboratory (fig. 1). The plastic material is a polymer of methyl methacrylate which is used in the manufacture of plastic eyes. The largest form measured 42 by 32 mm., the smallest 38 by 22 mm. They were 3.5 to 4.0 mm. in thickness. For practical purposes, only the three largest sizes were actually used, and the one most frequently employed measured 38 by 28 mm., which is slightly smaller than that suggested by Wheeler. Experi-

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ence has proved the value of these forms. They are sterilized by immersion in 70-percent alcohol for 20 minutes.

TECHNIQUE

After suitable infiltration of the operative site with a 1-percent solution of novocaine with epinephrine, the lids are dissected up from the socket contents. As advised by Wheeler, only the skin and orbicularis should be included in the dissection. If the tarsus is identifiable, it may

granulation tissue has been resected, the shrinkage is minimal and need not be feared. An acrylic form that will fit snugly into the socket and fill out its dimensions is then chosen. The form should not have to be forced in if a sufficient assortment of forms is available. This step should take only a few seconds. The socket is now ready for the graft.

Following the method of Padgett,² a piece of epidermis approximately 3 by 4 in. in size and 0.010 in. to 0.012 in.

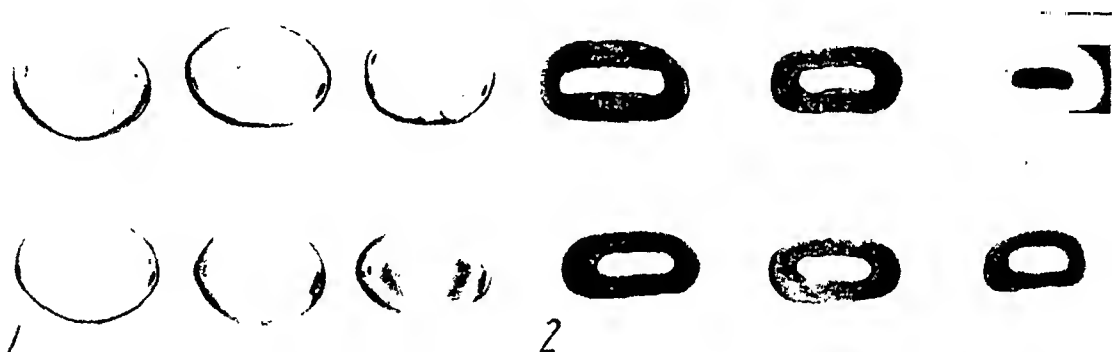


Fig. 1 (Fox). Acrylic forms. Largest measures 42 by 32 mm., smallest measures 38 by 22 mm.

Fig. 2. Types of skeleton conformer used after removal of acrylic form.

also be included; if not, there is no great loss. Every attempt should be made to preserve as much of the lid edges as possible, for these will contribute greatly to the final cosmetic result. Unfortunately, in cases of severe trauma, this is not always possible. The dissection is carried downward beyond the orbital rim to the periosteum, laterally under the canthi, and above to the orbital roof. An external canthotomy frequently facilitates exposure and mobility of the lids, as has been pointed out by Wheeler.

The next step is to resect all fibrous and granulation tissue. This cannot be emphasized too strongly. Sad experience has shown that it is failure to remove all traces of such tissue that causes most of the subsequent shrinkage. The epidermal graft will shrink also, but, if it is placed on a bed from which all fibrous and

in thickness is cut from the inner middle aspect of the arm; the dermatome is placed on a previously prepared flat surface, such as a small table, with the epidermic graft still adherent to it. Two corners of the narrower dimension of the graft are grasped in small clamps, and enough of the graft is peeled away from the drum to permit the previously chosen acrylic form to be slipped under it. Then, as the rest of the graft is peeled off, it is wound around the entire form, epithelial side inward. A graft of this size allows for some overlapping and assures sufficient tissue so that stretching will not be necessary.

The dermatome cement causes the graft to adhere to the form and makes subsequent handling easy. Any one who has had experience with the dermatome knows that, unless powder is used, or

unless the graft is taken on a layer of oiled silk, cellophane, or some similar material, there will be trouble from the curling and gluing together of the graft. The method described here makes all this unnecessary, and the graft is ready for

need for this. Furthermore, damming up of secretions may prevent a "take."

The eye dressing is removed after seven days, excess graft between the lids removed, the surface irrigated with warm boric-acid solution, and the pressure

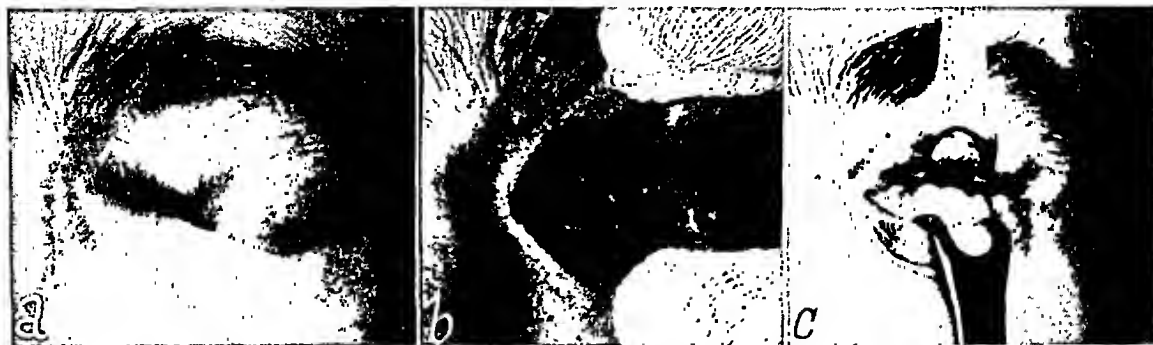


Fig. 3 (Fox). a. Lacrimal cyst of socket following enucleation in German prison hospital. b. Appearance of socket following resection of cyst. c. Epidermic graft of outer two thirds of socket.



Fig. 4 (Fox). a. Obliteration of inner half of socket and lower fornix after combat injury. b. After socket reconstruction and before repair of lower-lid edge. Note transparent acrylic form in place.

immediate insertion into the socket. This is done with the overlapped portion facing outward. The lids are not sutured together. A patch and several gauze fluffs, over which a firm pressure dressing is applied, complete the eye dressing. The donor site is covered with a strip of vaseline gauze and a snug bandage. When this is removed after 12 days, the site is usually found to be completely healed. No oiled silk nor similar material that prevents absorption of discharge should be used as part of the eye dressing. Since no skin sutures are used that may become adherent to the gauze, there is no

bandage reapplied for five more days. By this time, the graft has "taken" completely. The form may be removed, the socket irrigated, and all excess epidermic tissue cleaned away. The inside of the socket is coated with a thin layer of some bland sterile ointment, and a skeleton conformer (fig. 2) is inserted. An ordinary patch, which is changed daily, is applied, and the socket cleaned and irrigated. Since the conformer allows adequate drainage, it need not be removed. At the end of another week, a permanent prosthesis may be inserted.

The same procedure is used whether a

whole or partial socket is to be constructed, for the reason that, unless a piece of epidermis large enough to overlap is taken, it is hard to handle and one is not quite sure of its staying in place. Consequently, in all cases, total or sub-

technique is followed carefully, a "take" is practically assured.

DISCUSSION

Basically, the technique outlined does not differ much from Wheeler's method.



Fig. 5 (Fox). a. Obliteration of upper and lower fornices and outer half of socket following combat injury. b. Repair with epidermis. An external canthoplasty was performed later, to complete the repair.



Fig. 6 (Fox). a. Obliteration of fundus and lower fornix after combat injury. b. Repair with epidermis taken with skin knife. Upper- and lower-lid repair and brow plasty were also performed.

total, enough epidermis is taken to cover the form completely. Since epidermis can easily be spared, and is quickly replaced, one need not hesitate to take a little too much. Too little may necessitate further surgery; too much prevents it. If this

The changes suggested here simply apply recent scientific advances and methods to Wheeler's technique to make it quicker, easier, and simpler to carry out. This was found necessary under war conditions where there was much work to be done,

and time was always at a premium.

The substitution of the acrylic form for the dental-compound stent does much to simplify the procedure. Molding of the dental compound mud-pie fashion is an irksome and wearisome business. The water in which the stent is fashioned must be the right temperature—about 120°F. If hotter than this, the stuff sticks to the

gather, the merits of the skin knife versus the dermatome for small epidermic grafts is a favorite controversial subject. After giving both instruments extensive trial, the dermatome is, for me, the ideal instrument for taking epidermic grafts, however small. The reasons are: (1) Facility in handling the dermatome is not much more difficult to acquire than dex-



Fig. 7 (Fox). a. All conjunctiva of socket obliterated by lye burn and socket contracted by fibrous tissue. Photograph was taken after enucleation. b. Repair with epidermic graft taken with skin knife. Note saving of caruncle, which is important cosmetically.

gloves like glue. If colder, it cannot be molded. It must be constantly dipped in hot then cold solution, first to soften then to harden, until the proper size, shape, and smoothness are obtained. Use of an acrylic form, on the other hand, does away with all this. Experience has shown that one of the three largest conformers pictured in Figure 1 is usually required. Correct size is easily and rapidly ascertained and, once decided on, the form is laid aside until the graft is taken. The whole operation can be done without hurrying in 30 to 40 minutes.

Use of the dermatome instead of the skin knife also adds to the smoothness of the procedure. Wherever plastic surgeons

terity in handling the skin knife. (2) A graft of uniform thinness is obtained at all times. (3) Simply by applying the dermatome cement to pattern, any size or shape of graft is easily obtained. (4) By using the technique herein described, curling, shrinking and adhesions of the graft are prevented. All these factors more than make up for the few minutes spent in setting up the dermatome and applying the cement.

Many donor sites offer themselves: the anterior abdominal wall, the back, the outer or inner thigh, and the arm. As the donor site, I prefer the middle of the inner aspect of the arm, for it is easily accessible, and the skin here is hairless, requiring only the usual routine, preopera-

tive preparation. Postoperatively, the site is easily dressed and causes the patient less inconvenience during convalescence

such a socket clean of debris, infection, and odor. Presumably, this is especially true of those sockets containing a mixed

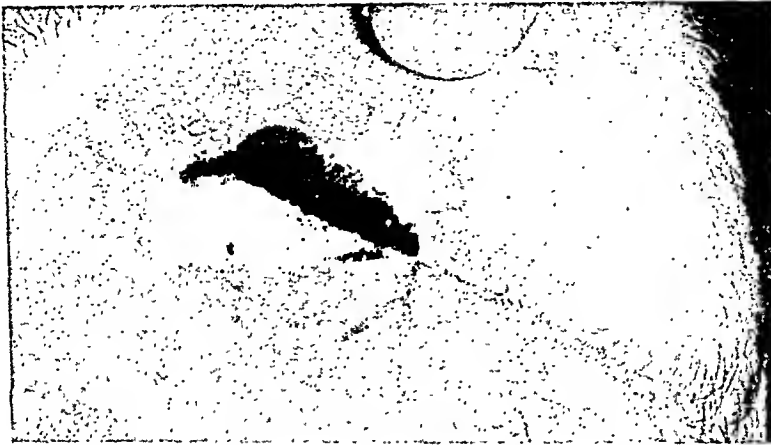
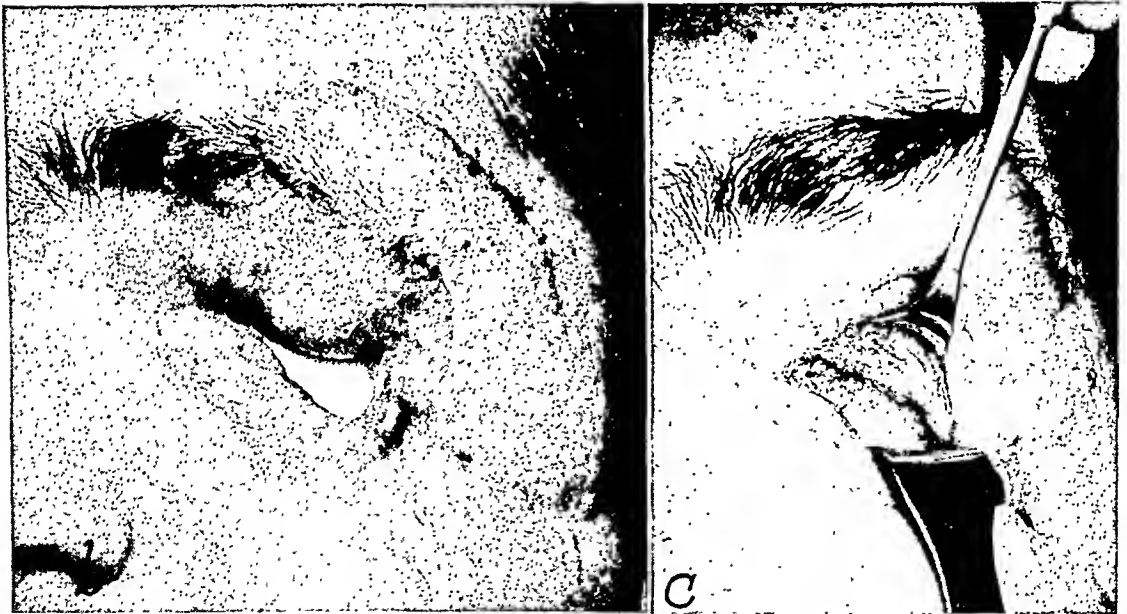


Fig. 8a (Fox). Complete destruction of lids and socket.



Figs. 8b and c (Fox). b. Esser inlay of epidermis fashioned under remnant of lower lid. Appearance after opening with acrylic conformer in place. Note delayed pedicle flap including part of brow. This was rotated down subsequently to form part of skin and lids. c. A later stage after rotation of flap and opening of socket.

than would the taking of a graft from the thigh or abdomen.

The matter of hygienic care of the socket after this type of operation is important. Much has been said and written concerning the difficulty of keeping

lining of epidermis and mucous membrane. After having placed a large number of socket grafts of various kinds, I must confess that I have noted little difference in either odor or discharge among the mucous-membrane, epidermic, or

mixed-graft socket. A large proportion of them become easily infected and have a muco-purulent discharge. To some extent, this is true of all empty sockets, grafted and non-grafted. It should be remembered that an empty socket does not have the benefit of a normal tear mechanism, which is the cleansing agent of the eye. When the lower punctum is absent, as it is in many cases of severe trauma, this is especially true. Tears, mucus, and debris tend to collect and stagnate. Low-grade infections are easily set up and are hard to clear. If epidermic grafts are too thick—and this is sometimes true of those taken with the knife—sebaceous material and epithelial debris will aggravate the condition. Use of the dermatome, which permits the taking of an exceedingly thin, uniform graft, tends to obviate this to a large extent.

The patient must be carefully instructed in the proper care of such a socket with careful cleansing and irrigations. This is a requisite in all these cases. When infection has set in, I have tried everything including the sulfonamides and penicillin in both ointment and liquid bases. In acute infections, penicillin ther-

apy is ideal. In the chronic conditions, however, I have, as yet, found nothing to replace 1- or 2-percent silver-nitrate solution firmly applied to the socket daily with an applicator. It works well on both mucous membrane and epidermis.

Six cases of epidermic socket grafts are pictured in Figures 2 to 8. Five of these figures present pictures of battle casualties; the sixth is of a private case in which the injury was caused by lye burn. These six cases have been chosen because each represents a somewhat different site of injury and type of problem. In only two cases was the skin knife used (figs. 6 and 7). In four of these (figs. 4, 5, 6, and 8), socket reconstruction was incidental to more extensive repair.

SUMMARY

By using a series of acrylic forms, socket reconstruction with epidermis, both total and subtotal, is expedited and facilitated. Use of the Padgett dermatome assures a uniformly thin graft which is easily handled if the technique outlined above is followed. The middle of the inner arm is favored as the donor site.

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NOTES, CASES, INSTRUMENTS

GLAUCOMA FOLLOWING THE INGESTION OF SULFATHIAZOLE*

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Penicillin has to a large degree supplanted the use of the sulfonamides in the therapy of many bacterial infections, but the use of sulfonamides is still so widespread that the report of an unusual reaction is deemed of interest.

Alvaro¹ in 1943 reviewed the effects other than anti-infectious of the sulfonamide compounds on the human eye. These included: (1) palpebral edema, (2) conjunctivitis, (3) chemosis, (4) scleral reaction, (5) numerous cells in the aqueous and iritis, (6) mydriasis, (7) cataract, (8) changes in the angioscotomas, (9) edema of the retina, (10) reduction of the visual fields, (11) retinal hemorrhages, (12) optic neuritis, (13) undefined or unidentified blurred vision, (14) transient ametropia, (15) changes in accommodation and heterophorias.

No subsequent or previous case reports or reviews at our disposal concerning the effects of the sulfonamide compounds on the human eye add to Alvaro's list. The following case is one of acute congestive glaucoma following the ingestion of sulfathiazole.

CASE REPORT

A white woman, aged 24 years, was seen in the eye clinic of the station hospital, MacDill Field, Tampa, Florida, on the afternoon of April 11, 1945. She said

* From the Eye Clinic of the Station Hospital, MacDill Field, Tampa, Florida.

that itching, light sensitivity, and burning of both eyes had been troublesome since she awakened that morning. Upon questioning, it was discovered that the patient thought she was sensitive to sulfathiazole, having developed red, burning eyes following the ingestion of sulfathiazole prescribed for a sore throat in August, 1944. She had reported this suspected sensitivity to the drug to the medical officer who had seen her in her unit dispensary because of a sore throat on April 10, 1945, but he told her to try the drug again, and that if she proved sensitive it could be discontinued without harm.

Examination showed a mild conjunctivitis in both eyes with a few subconjunctival hemorrhages suggestive of Koch-Weeks infection. Microscopic examination of a stain smear of the conjunctival secretions, however, revealed no organism. Bacterial culture was reported negative after 48 hours. A mild astringent collyrium was prescribed, and the patient was sent back to duty. She was told to stop using the sulfathiazole and report back to the eye clinic in 48 hours.

By the next evening, the pain and redness of the eyes were worse and a severe headache had developed. She again reported to her dispensary. She was sent from the dispensary to the hospital for admission where the chief complaint was recorded as severe headache and pain in both eyes. General physical examination was negative except for the eyes. Temperature, pulse, and respiration were normal. Kahn test of the blood, urinalysis and a complete blood count were normal.

She was seen in the eye clinic early on the morning of April 13th. At this time, her eyes had the typical appearance of acute congestive glaucoma, and this diagnosis was made by Capt. Meyer Kesert. Vision was: O.U., 20/30 correctable to

20/20 with a: O.D., +1.50D. cyl. ax. 105°; O.S., +0.25D. sph. \ominus +1.25D. cyl. ax. 75°. There was edema of the eye lids, marked chemosis of the conjunctiva, mild iris edema, small irregular pupils that reacted sluggishly to light and accommodation, normal ocular fundi (as nearly as one could determine through the undilated pupils), and obviously increased intraocular pressure on palpation. Tension at 2:15 p.m. on April 13th was: right eye, 50 mm. (McLean); left eye, 60 mm. One drop of ¼-percent eserine salicylate was placed in each eye every 10 minutes until three doses had been given. At 3:30 p.m., tension of the right was 35 mm., and of the left eye, 22 mm. The considerable relief of the eye pain was accompanied by subsidence of the headache. However, the itching, burning, and general appearance of the eyes remained the same. One drop of ¼-percent eserine salicylate was placed in each eye every hour for 24 hours. On April 14th, tension of the right eye was 38 mm., of the left eye, 35 mm. By April 16th, the chemosis had subsided; the pupils were of normal size and were reacting briskly to light and accommodation. Tension in both eyes was 28 mm. On April 17th tension was: O.D., 24 mm., O.S., 20 mm. The small conjunctival hemorrhages were reduced in number.

Eserine was discontinued on April 18th. From that date until her discharge on April 21st, tension remained 22 mm. in each eye, and the eyes continued to improve until they were considered normal on the day of discharge.

The patient was seen again in the eye clinic two weeks and four weeks following discharge. The tension remained the same and the eyes appeared normal. Because of the severe reaction of this patient's eyes to sulfathiazole, an attempt to reproduce this syndrome by readministration of the drug was not considered justifiable. However, it is felt that this glaucoma was unquestionably initiated by ocular sensitivity to the drug, especially in view of the fact that the patient suffered a much milder reaction in August, 1944. A skin test was not done.

COMMENT AND CONCLUSIONS

A brief review of the effects other than anti-infectious of the sulfonamide compounds on the human eye discloses 15 reactions. A case report of acute congestive glaucoma in both eyes in a patient sensitive to sulfathiazole is reported and added to the list of ocular reactions to these compounds.

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DACRYOCYSTORHINOSTOMY

A SIMPLIFIED TECHNIQUE

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In the light of our present knowledge, it is generally agreed that the only satisfactory and certain method of restoring the communication between the lacrimal

sac and the nasal cavity, once it has been permanently obstructed, is by surgery. A great many operations have been devised to overcome obstructions in the conducting portion of the lacrimal apparatus. Medical historians note in remote medical annals that crude attempts were made to overcome obstructions to the conducting portion of the lacrimal apparatus, but

the description of such an operation by Toti of Milan, Italy, in 1909 was the beginning of what might aptly be termed the modern surgical approach. Since that time there have been a great many modifications of the operation described. Dupuy-Dutemps, Lagrange, Mosher, and West are a few of the many writers on the subject that could be mentioned.

In the past, these operations have usually been of such great technical complexity that very few surgeons have been able to perform them with facility. By way of emphasis it may be stated that even the most skillful operators have experienced difficulty in suturing the edges of the lacrimal sac to the nasal mucosa, a step in many of the operations. Anyone who has attempted this procedure will realize the difficulties encountered. Many of the operations which have been described for the relief of obstruction in the conducting portion of the lacrimal apparatus represent efforts to simplify the techniques of this procedure, and each has contributed its share to this endeavor. It is with a view to simplifying the procedure further that this report is presented.

For the past 15 years, the writer has been using a method which greatly shortens the time required to perform a dacryocystorhinostomy and, at the same time, overcomes many of the difficult technical phases of the older procedures. The modification has proved to be entirely satisfactory in practice, and it is believed worthy of a trial by all those who are interested in performing such an operation with minimum difficulty and in minimum time.

In performing the operation according to this method, the lacrimal sac is exposed in the usual manner by a curvilinear incision at the inner canthus directly over the lacrimal sac. The incision is carried down to the sac which is exposed and elevated from its bed from the point

where it enters the bony canal upward to the internal canthal ligament. Rarely is it necessary, or advisable, to cut through the internal canthal ligament, but if required for better exposure, this may be done. The sac is severed at the point of entrance into the bony canal and its lower end lifted out of the lacrimal fossa. The remaining portion of the lacrimal passage which is in the bony portion of the canal is destroyed by curettement.

An opening is made through the bone in the depths of the lacrimal fossa with a small chisel or gouge, and a button of bone is removed. The opening may be made round or square, either shape serving equally satisfactorily. The opening should be at least one centimeter in diameter. The mucous membrane of the nose is thus exposed and is cut through by means of a crucial incision. A Graefe cataract knife serves admirably for this purpose. The edges of the nasal mucosa may be trimmed away if desired, but this is an unnecessary refinement.

The lacrimal sac is then slit for a short distance from its bottom on the anterior surface in order to facilitate the introduction of a small (10 or 14 F.) soft rubber catheter. The catheter is transfixated at its upper extremity with a double-armed suture of 00 or 000 plain catgut which is carried into the interior of the lacrimal sac to its apex and out through the skin, first one needle and then the other being passed. The points of emergence are separated by a distance of approximately one-eighth inch. By simultaneous traction on the two sutures, the catheter can then be pulled up into the sac and will remain in position when the sutures are tied. The sac is then pulled sufficiently far down on to the catheter to eliminate any unnecessary folds or wrinkles, and the lower border of the sac is fixed to the side of the catheter with a 00 or 000 plain catgut suture passed through the wall of the

catheter and the lower end of the severed lacrimal sac. More sutures than one may be used if necessary.

The free end of the catheter is then introduced into the opening in the nose and pulled out through the nostril on the same side. As the catheter is pulled into the nose, the lacrimal sac will be pulled with it, and the walls of the sac will come in contact with the nasal mucous membrane. The overlying tissues are closed in the usual manner. If the internal canthal ligament has been cut through, it must be carefully reapproximated by suture. In from three to five days, the sutures which have been holding the catheter in position will have absorbed sufficiently to enable its removal by pulling on the end protruding from the nostril. Each day after the third day, an attempt to remove the catheter is made by gently pulling on its free end. No attempt at forcible removal should be made as the catheter will eventually come away with ease.

Subsequent treatment will minimize the possibility of closure of the newly created channel. It may be necessary to pass lacrimal probes at intervals to maintain patency of the new lacrimo-nasal passage, or exuberant granulations may have to be reduced by cauterants, such as silver nitrate, trichloroacetic acid, or small biting forceps used within the nose at the exact point indicated. Failures in performing this operation will be lessened by

proper selection of the cases for operation. Making a sufficiently large opening through the bony structures into the nose will also contribute to the operation's successful termination.

The procedure herein described has been sufficiently satisfactory in our practice to cause us to believe that it deserves more general adoption. In all instances where we have employed the operation it has been used on adults, most of them in the age group from 40 to 60 years, but we know of no contraindication for its use in younger persons should it be deemed necessary.

Local anesthesia (two-percent novocaine solution, plus adrenalin) is used for the skin and subcutaneous tissues. Deeper infiltration with a small amount of the anesthetic solution will obtain anesthesia of the bony structures. The nasal mucosa is anesthetized by placing a tampon of cotton saturated with a five-percent cocaine hydrochloride solution in front of the anterior tip of the middle turbinate body and allowing it to remain for at least five minutes. We have tried injecting two-percent novocaine into the nasal mucosa instead of the cocaine pack but have found that the ballooning of the mucosa through infiltration increases the surgical difficulties; for this reason, the former procedure is considered preferable.

323-25 Medical Arts Building.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

February 4, 1946

DR. MAURICE L. WIESELTHIER, *presiding*

TETANUS FOLLOWING OCULAR INJURY

DR. CHARLES LITWIN said that tetanus is very rarely encountered in ophthalmic practice and that one may practice ophthalmology a lifetime without ever seeing a case. However, it is a very serious disease, in spite of the availability of simple and practical methods for its prevention. It should always be borne in mind whenever a fresh severe injury of the eye or adnexa is dealt with. It is more apt to occur after injury to the lids and orbit rather than to the eye itself, especially when the object with which the injury was produced has been in contact with the ground. Dirty wood and earth contain the spores of tetanus bacilli. Diagnosis is easily made by dysphagia, trismus, facial paralysis, and opisthotonos. Prognosis in these cases is very bad. When a severe and dirty case of injury to the orbit comes under treatment, the first precaution is to inject the serum, then cleanse the wound thoroughly and remove any foreign body. In good surgical practice and in war injuries, antitoxin is administered routinely. Sometimes routine precautions may be overlooked with dire consequences as in the case here presented.

D. H., an eight-year old white boy, fell from a one-story roof into a wooden fence on August 16, 1945. He suffered lacerations of the right eyelid, face, and upper lip. These were sutured in a local hos-

pital. Two weeks after the accident, he became irritable, listless, restless, and could not sleep. Tightness of the jaws developed. On September 8th, he suddenly developed paroxysmal contractions of his back muscles, which lasted nearly 10 minutes. Tightness of the jaws was followed by inability to open the mouth and to swallow. At this time, there was a local poliomyelitis epidemic and he was rushed to the county isolation hospital. On admission, there was found to be edema of the right eyelids and a purulent discharge from the conjunctival sac. There was no evidence of any paralysis of the skeletal muscles nor any cranial nerve involvement. There was trismus of both masseter muscles. The face showed spasm of the muscles (risus sardonicus); there was boardlike rigidity of the neck and back muscles. The abdominal muscles were stiff and on the slightest irritation, such as testing abdominal skin reflexes, contraction of all the trunk muscles set in leading to extreme opisthotonos. Temperature was 101.7°F. Laboratory findings were: urine, 2+ albumin; red blood count, 4,290,000; hemoglobin, 76 percent; white blood count, 5,950; spinal fluid—colorless; cell count, 4; globulin, negative; 68 mg. of sugar; no growth of organism. A diagnosis of tetanus was made.

The treatment consisted of tetanus antitoxin given intravenously in 10 progressive daily doses of 20,000 to 40,000 units, and 120,000 units of penicillin daily for eight days. To reduce hyperalgesia of the skin and reflex irritability, the patient was kept under the constant influence of luminal sodium. A 50-percent magnesium-sulfate solution was given to prevent the spasms of diaphragm and glottis which

occurred four to five times during the first four days he was in the hospital.

After two weeks the condition had improved so that he could open his mouth without difficulty and could swallow easily. The stiffness of the muscles of the trunk and extremities were noticeably less, and his posture and gait were normal. On October 7th he was discharged as recovered but was advised to consult an eye specialist.

On November 8, 1945, he was seen by Dr. Littwin. The upper lid of the right eye was swollen almost shut and there was a thick, purulent discharge from the conjunctiva. A diagnosis of a foreign body in the lid was made, and the next morning, under general anesthesia, an incision was made in the skin and a splinter of wood about $\frac{3}{4}$ by $\frac{1}{4}$ inch was removed. Recovery was uneventful.

FUNDUS FINDING IN LUPUS ERYTHEMATOSUS

DR. JULES LANDOWSKI reported the fundus pathology in two cases of acute lupus erythematosus. Both cases showed striking similarities as to their history and course. The fundi in both patients showed some vascular changes and a varying number of small, round, whitish exudates scattered over the retina in close connection with the retinal vessels. The localization of the fundus lesions in both cases seemed identical, namely in the nerve-fiber layer of the retina. This was suggested by the localization of the exudates in the axilla of dividing vessels or by their extension from one vessel to a neighboring one. In addition some of these exudates had striations which, if there had been but a single lesion, could have been mistaken for a group of medullated nerve fibers. In both cases, one exudate had a small hemorrhage in its center. The

gradual disappearance of the exudates and the reappearance of new ones was also noticed.

In conclusion, it would seem that, if a patient with no evidence of angiospasm and with normal blood pressure presented a clinical picture suggesting the diagnosis of lupus erythematosus, the presence of fundus lesions as described should be considered a valuable factor for this diagnosis.

Discussion. Dr. Ferdinand L. P. Koch said that the drawings of the ocular fundi presented by Dr. Landowski exhibit lesions similar to those in the drawings of the case reported by Dr. William P. McGuire and Dr. Koch last November. (See this Journal, volume 29, number 10, page 1243.) However, they had reason to believe that evidences of vasculitis would be found only in the extreme periphery of the retinas when the more central white exudates were fresh, as is indicated in Dr. Landowski's slides. The location of these exudates is in question. It was not determinable whether they were in the choroid or in the retina. There was a relationship between the relative age of the exudates and the location of the lesions of peripheral vasculitis in that the older the appearance of the exudates, the more toward the optic-nerve head did the vasculitis appear to progress, without regard to whether the venous or arteriolar vasculature of the retina was involved. As a corollary, early vasculitis was observed not only in the retinal periphery near the ora serrata but, also, in the relatively avascular area of the macular region. As loss of nutrition of the retina progressed, primary optic atrophy gradually took place bilaterally.

It is of interest to speculate on the etiology of the protean manifestations that produce or are accompanied by such

fundus findings. Klemperer, Pollack, and Baehr postulated the changes as being occasioned by disturbances of physiology of the collagenous tissue of the body while Stokes, Beerman, and Ingraham suggested, inferentially, that these patients might be victims of a "vasculo-allergic" phenomenon. In any event, it is earnestly hoped that, with the aid of the ophthalmologist, internists will avail themselves of the information that might be theirs ophthalmoscopically in instances that suggest the Libman-Sacks syndrome by whatever name.

REITER'S DISEASE

DR. HERBERT M. KATZIN presented the ophthalmic aspect of a typical case of this disease, which occurs almost exclusively in males, usually without recurrences.

This 42-year-old man had nonmucous, nonbloody diarrhea for 2 to 3 days, was well for three weeks, then had dysuria and pyuria for five days. Conjunctivitis started two days after the urethritis, and a herpetiform rash appeared on the penis. The next day his knee and ankle were swollen and tender. Fever up to 102°F. supervened, and joint involvement spread. His eyes showed marked conjunctivitis and keratitis, with toxic damage to the superficial layers.

Laboratory data included leukocytosis, increased sedimentation rate, and sterile conjunctival cultures. Penicillin and sulfonamides did not affect the course of the disease, but typhoid vaccine was beneficial. After two months the patient was better, but superficial corneal opacities persisted. These disappeared during the next three months.

The etiology seems to be infectious, and a pleuropneumonia-like organism has been recovered from some cases, although not from this one. The eye complications

may include keratitis, iritis, synechiae, complicated cataract, secondary glaucoma, and blindness. The urologic complications may include ascending infections. The joint involvement is quite similar to that seen in rheumatic fever. The overall duration varies between one and six months.

DR. BERT L. VALLEE, in presenting the same case from the internist's viewpoint, said that this disease was not described in the United States until 1941 by Bauer and Engleman, although it had been independently observed in 1916 by Reiter, Fiessinger, and Macfee.

In about two thirds of the cases, the illness is preceded by mild diarrhea of 2 to 3 days, with a low-grade or no fever. There is a symptom-free interval of 3 to 4 weeks, and then suddenly an acute, purulent conjunctivitis and urethritis appear, either one preceding the other by a day or two. A few days later, migratory polyarthritis, resembling that of rheumatic fever, develops. Most frequently the weight-bearing joints of the lower extremities are affected. The conjunctivitis may be complicated by serious eye changes. As a general rule, however, the eye recovers. Colby has described prostatic abscesses, pyelonephritis, and hydronephrosis as complicating urologic features. Chronic arthritis has been described only rarely. Incomplete syndromes have been reported, consisting of urethritis and arthritis without conjunctivitis, and arthritis and conjunctivitis without urethritis. The disease usually runs an uncomplicated course for about 4 to 5 months, although the patient may recover within 3 to 4 weeks. Exacerbations are not uncommon. Hydrarthrosis may occur.

There may be skin lesions of vesicular character, which finally develop a keratotic appearance and are preferentially located over the affected joints, the scrotum, and

penis. These lesions resemble herpes pro-genitalis. The cutaneous manifestation has been described independently as keratosis blennorrhagica without gonorrhea. The lymph nodes and spleen may be transiently enlarged. There is moderate leukocytosis and the sedimentation rate is accelerated. The gonococcus is never found, and the G.C. complement fixation test is negative.

The disease has been reported only in males between the ages of 16 and 45, and the majority of cases occurred in soldiers, aged 20 to 25 years, during World Wars I and II. Until 1941 all reported cases were seen in Europe but, as many recent American papers show, this merely reflects an earlier interest of European physicians in the disease.

Pathologic examinations have usually shown a mild synovitis and fluid of high protein content in the joints. The etiology is obscure. Working independently, Reiter found spirochetes in the blood, and Macfee in the urethra of their patients. Recently Dienes isolated pleuropneumonia-like organisms from the urethra of a male patient who had the forme fruste of Reiter's disease. The morphologic characteristics of the spirochetes and the pleuropneumonia-like organisms show a striking resemblance. The pleuropneumonia-like organisms may be considered as possible etiologic agents in this disease. These organisms, moreover, cause an illness in sheep, agalactia, which in almost all of its manifestations resembles Reiter's disease.

The common chemotherapeutic agents of the sulfonamide and penicillin groups are of no avail. Foreign-protein fever therapy has been found most helpful, but gold therapy has been successfully used by Usseglio and Zaneau. The development of arthritis in mice and rats infected with this organism can be prevented by the

administration of gold salts if given early enough. Gold salts warrant further trial in the management of this disease.

Serologic investigations of patients with Reiter's disease are being carried out by Drs. Wallerstein, Turner, and Vallee.

Discussion. DR. ABRAHAM STRACHSTEIN said that recent American articles on Reiter's disease all emphasize the following three points: (1) Most patients reported are men in the armed services, although the civilian is by no means exempt. (2) The drugs that prove of such great value in urinary and in other infections such as penicillin and the sulfa drugs, seem to have no beneficial effect on the Reiter syndrome. (3) This disease, as previously stated, has thus far failed to reveal any specific germ which presumably acts as its cause.

Dr. Strachstein's patient was a married civilian who came under observation in December, 1944, suffering from Reiter's disease. He had already been treated by his family physician with the drugs mentioned, but without effect. The patient was hospitalized and received an intramuscular injection in the gluteal region of 10 c.c. of milk boiled for 10 minutes. Four hours later, the patient experienced a severe chill and a rise in temperature to 105°F. The fever persisted throughout the night and gradually subsided in the morning at which time the urethral discharge completely disappeared. The conjunctivitis began to clear prior to this injection, but the joint pains persisted. Salicylates were tried for six days with beneficial effect. Another injection of milk was again followed by a severe chill and a rise of temperature. On the following day the patient was agreeably surprised to find that all joint pains had entirely disappeared. The patient was in the hospital for 2½ weeks and left almost completely recovered. He remained under observation for

over 13 months without any recurrences. Typhoid vaccine was not used because isolated fatalities have been reported as resulting from its use.

In a recent article in the *Journal of Urology*, Captain Sargeant, U.S.N., reported 23 cases, in which foreign-protein fever therapy was of definite and distinct value in the treatment of Reiter's syndrome. Dr. Colby reported in 1934 that serious renal complications may arise and that some patients had serious joint deformities and remain ill for many months. He had not used the foreign-protein fever therapy.

Dr. Herbert M. Katzin said the spirochete which Reiter described, and similar organisms that were isolated by Macfee on the West Coast of Africa from patients with this syndrome, exhibited forms that were remarkably similar to the pleomorphic pleuropneumonia-like organisms isolated by the Boston workers. The use of foreign protein was first published in Germany in 1941, although Dr. Gartner had been using it in a case he had been following for some years. Several case reports suggest infection following sexual exposure. In one case, repeated recurrences followed 10 days after sexual intercourse, with a different partner in each instance. In another case, a man developed migratory arthritis and urethritis one week after marriage to a woman who had a vaginal discharge containing pleuropneumonia-like organisms. A previous case at the Mount Sinai Hospital was followed for 16 years with periods of recurrence.

CYCLOPIA

DR. SAMUEL GARTNER reported two cases of cyclops. One is a true single median eye; the other is a fused double eye. Both were located in the center of the forehead. Interesting anomalies were found in them.

The important position of the pigment epithelium was associated with an almost complete absence of choroid, choriocapillaris, and lamina vitrea, and maldevelopment of the overlying retina.

In one case, a misplaced island of retina was found buried in the choroid and sclera in an area where pigment epithelium was lacking. Some proof was found that this anomaly was due to metaplastic development of the pigment epithelium into a retinal type of structure.

Discussion. Dr. Joseph I. Pascal said that he once saw a case of cyclopia in Vienna. In the discussion on that case, a statement was made that the reason for the development of cyclopia is the fact that the anlage for the nose was above the two eyes and failed to descend and separate the two eyes, resulting in the fusion of the anlage of the two eyes into one. Dr. Pascal asked whether this was a plausible cause of the condition in Dr. Gartner's cases.

Dr. Gartner said that there were a great many theories with little proof. The damage of the midline structures that occur in fetal life may be created in animals by X rays and magnesium salts. It is not only due to maldevelopment of the nose, but to all the midline structures.

IRITIS IN BECHTEREW-STRUEMPPELL-PIERRE MARIE DISEASE

DR. F. N. GRAUPNER said that the difficulty in determining the etiologic factors in an acute iritis is well-known. The most common causes are tuberculosis and lues, but there are numerous other general diseases which are often complicated by a metastatic inflammatory process in the iris and ciliary body. The statistics by Gilbert of 500 cases of iritis showed that tuberculosis caused 46 percent; lues, 17 percent; gonorrhea, 3 percent; rheumatism, 3 percent; unknown causes, 18 per-

cent. Guyton and Woods found similar figures.

Belonging to the group of rheumatic diseases, the spondylitis ankylopoietica of Bechterew-Struempell-Pierre Marie is often complicated by an iritis of the recurrent type, according to Dunham and Kautz in 25 percent of all cases. In fact, the relation between spondylitis and iritis is better known to surgeons and orthopedists than to ophthalmologists, so that the ophthalmic literature on this subject is relatively small. The first person to mention the occurrence of an iritis in spondylitis was Fraenkel in 1904; later Fischer, Vontz, Vogt, Kraupa, Kuntz, Marbaix, and Golding reported similar cases.

The spondylitis ankylopoietica is a chronic rheumatic disease. The first to describe this stiffness of the spine were Bechterew, Struempell, and Pierre Marie in 1895. Later with the help of the X ray, the disease was better explored and classified. Today the whole classification of arthritis is still under discussion but, according to Cecil, arthritis is due to five different agents: (1) Infectious arthritis due to gonococcus, staphylococcus, streptococcus, pneumococcus, syphilis, tuberculosis, and other agents. (2) Probable infectious origins, such as rheumatoid arthritis of the adult type, juvenile type (Still's disease), or ankylosing spondylitis. (3) The degenerative joint diseases. (4) Arthritis due to metabolic disturbances as in gout. (5) Neuropathic arthritis (tabes and syringomyelia).

Three cases of iritis due to spondylitis (Bechterew-Struempell-Pierre Marie) were presented by Dr. Graupner. This rheumatoid arthritis produces complete fusion of the vertebra and extreme stiffness of the spine. The iritis is of a recurrent type characterized by a gelatinous, fast-disappearing exudate in the anterior

chamber, fine dustlike precipitates, and synechiae of the pigment leaf of the iris. This diffuse, metastatic iritis is in contrast to the iritis in such granulomatous diseases as tuberculosis and lues which are more severe, involve the ciliary body, and are of longer duration. Since the iritis is a sign of rheumatoid activity in the body, treatment should be directed against both the iritis and the underlying rheumatic disease.

Discussion. Dr. Milton Berliner said he saw the first case described by Dr. Graupner. Since that time, he has observed three additional cases which seemed to fall within this category. In each instance his attention was arrested by the fact that these patients had difficulty in placing their chins on the chin-rest of the biomicroscope. In two of the cases, there was a definite history of a chronic Neisserian infection. Dr. Graupner mentioned something about the clinical differential diagnosis between iritis of granulomatous and nongranulomatous origin, but Dr. Berliner did not believe that a differential diagnosis is always possible, since even in the granulomatous form, some mild, abortive, exudative cases may occur.

Dr. Daniel Rolett described a dentist who had to sleep outdoors a great deal while in the Army. Before entering the Army he was in perfect health. Soon after discharge from the Army because of poor health—his case was diagnosed at the Mayo Clinic as one of spondylitis deformans—he developed photophobia, pain, and blurred vision in the right eye. These persisted with periods of remission. One year after discharge from the Army, he presented recurrent iritis of the right eye. A mild ciliary infection was present with minute deposits on the posterior corneal surface, a swollen and edematous iris, but no evidence of adhesions. The patient did

not give any history of previous eye disease, nor did he mention that there was anything wrong with him physically. The first inkling of the disease was discovered when the patient was unable to adjust his neck to the chin support of the slitlamp and a peculiar limp was noted which was attributed by the patient to a "weak hip joint." X-ray studies of the spine confirmed the diagnosis of spondylitis deformans. The patient refused to take atropine locally as it would interfere with his work as a dentist. Therefore, no local treatment was administered with the exception of hot packs to the eye once daily. Atophan (7 gr.) was given twice daily. On the third day, remarkable improvement in the eye was noted with absence of any inflammation. Treatment was stopped.

Comdr. Arthur A. Knapp said that he had seen many arthritic conditions in the arthritis clinic in the Hospital for Special Surgery over a period of years. They included various types of arthritis, some with spondylitis. The majority of individuals never suffer from any external ocular disease. It is rare to see iritis or any external ocular disease in arthritis.

RUBEOSIS IRIDIS

DR. JACK V. LISMAN reported a case of rubeosis iridis in a diabetic patient. The diabetes was of long standing, mild, and easily controlled.

The patient presented the typical picture of rubeosis in the right eye. There was a red ring of small capillaries surrounding the pupil with several vessels running peripherally in to the angle. The tension was extremely high and responded very poorly to miotics. Perception of light was soon lost. The eye was very painful, with the pain controlled somewhat by atropine. Because of the pain, the eye was

finally enucleated. Examination of the enucleated eye revealed a newly formed membrane on the surface of the iris extending into the pupillary area; the angle was obliterated by synechiae; the optic nerve was deeply cupped; and numerous hemorrhages and exudates were present in the retina.

Three months after the onset of rubeosis in the right eye, the left eye became painful, with an elevated tension and the picture of rubeosis iridis. The tension was controlled for a period of two weeks by a posterior-scleral trephine; the operation did not result in any significant bleeding. A Lagrange sclerectomy was performed when the tension began to rise. The tension remained controlled for a while and then there were repeated hemorrhages in the anterior chamber with elevated tension and ultimate blindness.

The glaucoma associated with rubeosis iridis responds better to mydriatics than to miotics. This is probably due to a mechanical squeezing out of blood from the capillaries on the iris as the pupil dilates.

Discussion. Dr. Ernst Waldstein said that, considering the great number of diabetic patients, it is certainly surprising that rubeosis iridis is such a rare affection. It is the more surprising since, as the late Dr. Agatston emphasized, pathologic changes in the retinal veins are so common that we might safely say they are practically always present in all the more advanced diabetic cases. Still rarer, of course, is the bilateral occurrence of iris rubeosis. Among other symptoms associated with rubeosis of the iris is a certain ruddiness of the face, especially of the forehead, and anomalies in the capillaries of the nailbed. Anent Dr. Lisman's recommendation of atropine in secondary glaucoma of rubeosis patients, it would seem

a much safer procedure to use 10-percent neosynephrine.

DENTAL AFFECTIONS IN OCULAR DISORDERS

DR. DANIEL KRAVITZ presented a paper on this subject which was published in this Journal, volume 29, number 9, September, 1946.

Leon H. Ehrlich,
Secretary.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

February 12, 1946

DR. J. WESLEY MCKINNEY, *presiding*

CHOROIDAL DETACHMENT FOLLOWING OPERATION FOR RETINAL DETACHMENT

DR. J. WESLEY MCKINNEY reported the case of Mr. W. H. W., aged 68 years, who was first seen in November, 1945. The right eye had been blind for 14 years as a result of uveitis. There had been several attacks of anterior uveitis in the left eye. Three weeks before he had noticed a black streak before the left eye which had spread to involve almost the entire field of vision.

Examination revealed no light perception in the right eye and 20/400 vision in the left. The tension in the left eye was normal. There was an aqueous flare but no cells in the anterior chamber. The iris was bound down by a few fine posterior synechiae. The vitreous was very hazy. The upper two thirds of the retina was detached to the disc and including the macula. There was a large horseshoe tear at the 12:30-o'clock position and a larger wedge-shaped tear at the 3-o'clock position. Operation was refused at the time, but the patient returned in a few days with the entire retina detached. He was

operated upon December 5, 1945. The postoperative course was uneventful. Both tears were apparently sealed and the retina reattached.

He returned on January 14, 1946, stating that he had suddenly gone blind again two days previously. The retina was everywhere detached except in the upper one fourth. The upper tear was well sealed but the temporal tear was not. He refused reoperation until January 29th when diathermy was again applied to the region of the temporal tear. At the first dressing, a large choroidal detachment was seen nasally which progressed to obscure a view of the disc. The choroidal detachment had gradually subsided and apparently the retina was reattached, although visibility of the retina was not, as yet, too good.

POSTHERPETIC NEURALGIA

DR. J. WESLEY MCKINNEY reported the case of Mr. I. W. W., aged 25 years, who gave the history of having blisters over the left side of the forehead with severe pain one month before. The eye was very red for three weeks. The blisters were present for only one week. Examination showed the skin over the left side of the forehead and back into the hair to be red, slightly elevated, indurated, and hyperesthetic, corresponding to the distribution of the ophthalmic division of the fifth nerve. The nasociliary branch was not involved. The left eye was not inflamed. Corneal anesthesia was marked. There were three superficial opacities of the cornea, temporally. The eye was otherwise normal. The condition was considered to be postherpetic neuralgia. Eucupine-procaine with adrenalin (0.5 c.c.) was injected into the supraorbital nerve. He was partially relieved by this injection. Close questioning brought out the fact that the remaining pain was more temporally, so eucupine-procaine (0.5

c.c.) was injected into the region of the lacrimal nerve. The next day there remained a small area of pain in the temple which corresponded to the area of the zygomaticotemporal nerve. When this nerve was injected, the pain was completely controlled. Ten days later he had had no return of pain. The skin of the involved area seemed normal and was not hyperesthetic.

ANOMALIES OF ACCOMMODATION

DR. PHILIP MERIWETHER LEWIS reported two cases with unusual accommodative findings.

Case 1. F. H., a white man, aged 30 years, complained of being unable to read ordinary print except for a very short period. He had noticed this condition for the past two or three months and thought it was gradually getting worse. Vision was 20/20 and J1 in each eye but his accommodation measured only 2.5 diopters separately and 3 diopters with both eyes together. No other abnormality was discovered. Manifest and homatropine refraction showed only a slight hyperopia, +0.50D. sph., O.U. Except for being a thin and rather frail looking individual, the man's physical examination and laboratory findings were negative. He had not been ill. His occupation as a printer required rather close confinement and exposure to considerable fumes from molten type metal. He was given a +1 sph. for reading, rather large doses of mixed vitamins, and suggestions for a better diet. He took a three weeks' vacation and an increased amount of outdoor exercise. After two months, his accommodation had increased to 4.5 diopters and reading was more comfortable.

Case 2. Mrs. R. E., a white woman aged 48 years, complained that her eyes tired and watered excessively on attempting to read. She had worn glasses for the past four years, the present ones being

about three years old. Both times she had been fitted with bifocals. She was wearing: O.D., +0.50D. sph. \subset +0.25D. cyl. ax. 180°; O.S., +25D. sph. \subset +0.75D. cyl. ax. 65°; with a +2 added for near. Except for a slight congestion of the conjunctiva of both eyes, examination was negative. Uncorrected vision was O.D., 20/70; O.S., 20/50. By manifest refraction, she measured: O.D., +1D. sph. \subset +75D. cyl. ax. 180° = 20/30; O.S., +25D. sph. \subset +75D. cyl. ax. 20° = 20/30. With this distance correction, she could read J1 in to 11 cm. from the anterior focal plane, which is equivalent to 9 diopters of accommodation. Measured separately the accommodation was slightly greater in the left than the right eye. No abnormality of the lenses was found to explain the unusually high accommodation. The distance refraction only was ordered.

INTERSTITIAL KERATITIS TREATED WITH PENICILLIN PACKS

DR. HAROLD KUSHI (by invitation) presented a case of syphilitic interstitial keratitis which was treated with penicillin packs.

Miss P. J. B., a white girl aged 12 years, was first seen on January 15, 1946, complaining of lacrimation, photophobia, redness, and blurring of vision which began about six months before. She had been treated by several doctors including an "eye specialist" with no apparent improvement. Examination on entry revealed the following:

Visual acuity in the right eye was 20/65; in the left eye, 20/30. Tension in both eyes was 25 mm. Hg (Schiotz). There was marked photophobia and lacrimation associated with conjunctival and ciliary injections. Both corneas showed numerous opacities and extensive vascularization. The pupil of the left eye was well dilated; that of the right eye was

contracted. Numerous keratitic precipitates were seen in the right eye with the slitlamp; none in the left eye. The fundus examination of the left eye revealed medullated nerve fibers adjacent to the disc on the nasal side. The fundus of the right eye was not visible. The patient's mouth revealed typical Hutchinson's teeth. The Wassermann test reaction was +4. The patient was admitted to the hospital and penicillin-impregnated cotton packs were applied to the lower cul-de-sac of both eyes for a period of two hours, twice a day. The concentration of the penicillin solution used was 20,000 units per c.c., and $\frac{1}{4}$ c.c. (5,000 units) was used for each application to each eye. Locally, atropine ointment was also used. She was given three injections of milk intramuscularly, two injections of bismuth, and two of mapharsen. Improvement in the form of absence of lacrimation and photophobia was noted 24 hours after the initiation of penicillin packs and atropine. Improvement was progressive and on discharge, 10 days after entry, both eyes showed only slight conjunctival and ciliary injections.

RECURRENT VITREOUS HEMORRHAGE (EALE'S DISEASE)

DR. HAROLD KUSHI (by invitation) presented a case of recurrent vitreous hemorrhage in a young man.

Mr. J. M., aged 27 years, was first seen in the Memphis Eye, Ear, Nose, and Throat Clinic on January 21, 1946, complaining of partial loss of vision in his left eye. Approximately three weeks prior to entry the patient had a sudden spontaneous loss of vision in his left eye followed by a partial return of vision after the use of "drops" which dilated his pupil. Vision again became blurry a week before entry. The patient had been blind in his right eye for the past five years. No history of injury to either eye was ob-

tainable. Examination on entry revealed the following:

Visual acuity of the right eye was light perception with no projection; in the left eye, 18/200. Tension in both eyes was 23 mm. Hg (Schiotz). There was a mature cataract in the right eye. The conjunctiva, cornea, and iris of both eyes appeared normal. Fundus examination of the left eye revealed a massive hemorrhage in the vitreous superimposed upon several white proliferative-type membranes. A tuberculin test gave a +2 reaction. X-ray studies of the chest revealed tubercular hilar glands. The Wassermann test was negative; so was the urinalysis. Atropine ointment was applied locally and potassium iodide was given internally. Visual acuity improved from 18/200 to 20/100. The patient was discharged from the hospital and given instructions for a series of old tuberculin treatments by his family doctor.

CHICAGO OPHTHALMOLOGICAL SOCIETY

February 18, 1946

PETER C. KRONFELD, *president*

CLINICAL PROGRAM

(Presented by the Department of Ophthalmology, The University of Chicago)

ENDOTHELIAL DYSTROPHY WITH COMPLICATED CATARACTS

DR. MAURICE J. DRELL presented V. D., a 43-year-old white man, whose case has been followed at The University of Chicago Eye Clinic since November, 1942, at which time he had corrected vision of 20/30 in each eye, a bilateral mild endothelial dystrophy, and immature subcapsular cataracts. The corrected vision dropped to 20/70 in each eye (April, 1944), and 20/100 in the right eye and

20/200 in the left eye (September, 1945). He returned in December, 1945, with a story of rather rapid loss of vision during the preceding weeks; unaided vision was finger counting at three feet in the right eye; barely 20/200 in the left. The dystrophy was unchanged. The left lens was mature and the right lens, almost mature. A right combined extracapsular extraction was done in December, 1945, with uneventful healing. On February 7, 1946, corrected right vision was 20/20 and 6-point printer's type.

BLOOD STAINING OF CORNEA

DR. MARTIN P. WOOLF presented the case of A. D. H., an 11-year-old white boy, who was seen in University of Chicago Clinics, October, 1945, with a history of having been struck on the right eye four months previously. The eye was not perforated but there was a history of two anterior-chamber hemorrhages following the injury. The anterior chamber was irrigated two weeks post injury.

Examination revealed a 7 to 10 degree divergence in the right eye. Light and color perception were present. There was a horizontal linear scar on the cornea of the right eye at the 12-o'clock position, a result of surgery. The posterior surface of the entire right cornea was covered by a greenish-brown, dense opacity except for a clear zone of about 1 to 2 mm. around the entire limbus. Under slitlamp examination the greenish-brown opacity had a ground-glass appearance which covered the entire posterior surface of the cornea except for the clear zone previously mentioned. There was a surgical coloboma of the iris at the 10-o'clock position. There were numerous brown granules on the iris.

Treatment was deferred, awaiting the degree of resorption. Later a keratoplasty may be considered.

GENERALIZED SARCOIDOSIS

DR. MARTIN P. WOOLF presented J. L. W., 27-year-old colored man who was seen by Dr. W. Jones at Provident Hospital and referred to The University of Chicago Clinics for further study. The patient was seen December, 1945, with a history of painful swelling of the left eyelids and injection of the left sclera in 1943. About one week after onset, several nodules, which are still present, appeared on each upper eyelid. In 1944, painless pea-sized nodules appeared on the skin of the neck, arms, groins, and legs. These are still present.

In April, 1945, a similar episode involved the patient's right eyelid and sclera more severely than the left eye had been involved. The pupil of the left eye was smaller than that of the right. When he was seen in September, 1945, his vision was: right eye, 20/20; left eye, 20/25. Both eyes were painful and red.

When seen again, in November, 1945, his vision was: right eye, 20/25; left eye, 20/160. Lesions on the left iris resembled those on the skin. The left pupil was small, irregular, and fixed. Red reflex in the left eye was very dull. The discs could not be seen. Attempted dilatation of the pupil was unsuccessful.

Visual acuity has remained unchanged, as have the lid, subconjunctival, and pericorneal infiltration, which are presumably sarcoidal. There are two intrairidic, gray-white, translucent nodules in the left eye. A biopsy of a shoulder nodule reveals sarcoid. X-ray studies of the fingers, toes, and chest are confirmatory.

BILATERAL MILD ENDOTHELIAL DYSTROPHY COMPLICATED BY UVEITIS WITH SECONDARY GLAUCOMA

DR. A. W. FELDMAN reviewed the case of O. N., a 66-year-old white man who presented himself at The University of

Chicago Eye Clinic on February 12, 1946, with the complaint of poor left vision of one week's duration. The patient stated that his eye had become "a little sore" about February 1, 1946. He paid little attention to this until, upon awakening one morning about a week later, he found a marked reduction of vision in the left eye. Compresses failed to give relief. Past and family history were noncontributory except for nocturia of several years' duration.

Examination revealed: aided vision in the right eye 20/16-3; aided vision in the left eye, finger counting at two feet. The left eye revealed a steamy cornea with a central film of grossly visible precipitates about 4 mm. in diameter. The right eye appeared grossly normal. Biomicroscopy revealed a guttate cornea of the right eye with scattered pigmented precipitates. The left cornea was also guttate and was carpeted with large, fatty, confluent precipitates. The left anterior chamber showed a faint aqueous ray, but no cells nor lens detail could be made out through the thick layer of precipitates. Tension readings were: R.E., 15 mm. Hg (Schiotz); L.E., 33 mm. Bjerrum fields showed a concentric constriction of the left field of vision to 20° with a 3/1,000 white target. Blood count, urinalysis, serology, agglutination tests, skin tests with Frei antigen, old tuberculin, and brucellergen were noncontributory, as were chest fluoroscopy and sedimentation rate.

Under heat and atropine therapy tension of the left eye has been controlled; aided vision in the left eye is 20/70. Diagnosis was: (1) Bilateral, mild endothelial dystrophy. (2) Left eye: uveitis with secondary glaucoma.

BILATERAL RETINAL AND MACULAR DYSTROPHY

DR. A. W. FELDMAN presented M.A.S.,

a 22-year-old white man, who came to The University of Chicago Eye Clinic with a complaint of "blurring of central vision" of six years' duration, temporarily improved with glasses. The history further revealed that except for an older sister with some eye trouble of unknown nature, no one else in the family had any eye difficulties.

Examination showed vision to be: O.U., 10/200 improved with his glasses to 20/200. The following pathologic conditions involved both macular regions. The macula was a red-brown color surrounded by a ring of bright red reflexes which was in turn surrounded by a brown granular zone. About two prism diopters from the fovea, there was another ring consisting of small, discrete, rather uniform, white opacities. A few such opacities were scattered in the periphery. Laboratory findings were non-contributory. Bjerrum fields revealed absolute central scotomas, 5 to 8 degrees in diameter. Examination of the patient's twin sister failed to reveal any pathologic condition of the fundus. Diagnosis was congenital retinal and macular dystrophy of the right and left eyes, etiology undetermined.

With telescopic lenses, the patient was able to see 14-point type with the right eye and 12-point, with the left eye. There was no appreciable improvement for distance.

PROBABLE TOXOPLASMAL CHORIORETINITIS

DR. F. S. RYERSON presented Miss P. M., aged 19 years, who was first seen at the clinic in January, 1946, with the complaint of seeing spots before her right eye. At the age of seven, she had told her mother that she could see only half of her. An oculist was consulted, and he informed the parents that vision in the left eye would not improve. This incident was followed by a period of approximately nine years of apparent inactivity of the eye disease. She saw an oculist in March,

1945, because of cloudy vision and floating spots. He noted vitreous exudates in the right eye and a large area of chorioretinitis at the 6-o'clock position in the periphery; this lesion appeared to be quiescent. The left eye revealed a quiescent chorioretinitic lesion involving the macular area. General examination, including X-ray studies of the teeth and sinuses, was negative. The patient was placed on a regime of proteolac injections, salicylates, and potassium iodide. At the same time, under the care of another physician, the patient was being treated with autogenous vaccines prepared from the feces. There was some improvement in vision of the right eye followed by an exacerbation in November, 1945.

When the patient was first seen at the clinic, vision was: O.D., 20/30; O.S., 20/200. Examination of the fundus revealed numerous floaters in the right vitreous and a veil-like haze which obscured fundus detail. A large, active chorioretinitic lesion was apparent about eight prism diopters below the right disc. Vitreous of the left eye was relatively clear. There was an old, inactive chorioretinitic scar with pigment disturbances on the left eye about 2 to 3 prism diopters in size and involving the macular area. Laboratory tests revealed normal hemogram and negative agglutinations. The skin tests with 1:1,000 old tuberculin and the Frei test were negative.

The patient was placed on vasodilators. Subsequently the right vitreous cleared slightly. On January 30, 1946, a 2+ aqueous ray and 15 to 20 cells were noted on slitlamp examination of the right eye. The patient was placed on a regime of 50 mg. of atabrine three times daily on alternate weeks. Subsequently, the activity in the right eye increased and again subsided somewhat. Central fields taken before the most recent episode revealed only

an absolute central scotoma on the left. Tentatively, the diagnosis was toxoplasmosis, awaiting further immunologic studies.

PROBABLE CONGLOMERATE TUBERCULE

DR. C. KEITH BARNES presented Mrs. C. J., a 37-year-old white woman, who stated that her vision had been quite normal until January, 1944, when she suddenly became aware of image distortion in the left eye. Vision deteriorated over a period of one year to about 20/200, O.U., and dropped in one more month to hand movements at two feet. She was seen by several specialists, but the process continued relentlessly. Subjective symptoms had been negligible throughout.

Examination revealed the left macular area to be occupied by a protruding, rounded, gray-white mass surrounded by a zone of radiating retinal traction folds. Two small, blurred, dull-white satellite patches were nearby, and the entire central retina showed pallor and edema. Temporally, a crescent of flat, blurred exudates could be seen, as well as two shrinking bands of proliferated scar tissue.

She received skin tests of tuberculin, brucellergin, and Frei vaccine; X-ray studies of the sinuses and chest; two hemograms and urinalyses; nose and throat cultures, sedimentation rate, serologic tests for lues, agglutination tests for typhoid, paratyphoids A and B, brucellosis, and proteus O19, as well as hourly temperature observations. The tests were noncontributory. Considerable dental work was needed and done. General medical and ear, nose, and throat consultations were noncontributory.

On the basis of the lesion's appearance and clinical course, it was thought to be a conglomerate tubercle of the choroid. The weaker dilutions of tuberculin gave negative skin tests. Lymph-gland biopsy, had

not been done, as the glands have only recently become palpable at all. The lesion seemed to be much shrunken and whiter. It was apparently subsiding into quiescence. Treatment has been supportive. Visual fields reveal a stationary, central scotoma of the left eye.

BILATERAL OPTIC NEURITIS

DR. MAURICE J. DRELL presented J. M., an eight-year-old white boy, who was first seen on December 3, 1945, with a history of pain in the eyes six days previously, rapidly followed by a total loss of vision in the right eye and great loss of vision in the left eye, together with subsidence of pain. Vision was: no light perception in the right eye; 5/200, left eye. He was able to identify yellow and blue correctly but said that red was purple. The right pupil did not react to light directly, although it did consensually; the left pupil reacted to light directly, but not consensually; both pupils were dilated and reacted well in convergence. The discs showed two diopters of elevation, peripapillary retinal rucking, distended veins, and grayish maculas. The left field showed extreme constriction, relatively more so nasally than temporally.

On December 5th, the right eye was able to distinguish a flashlight stimulus but not an ophthalmoscopic light. Vision in the left eye was 8/200. Both pupils reacted. The right disc was elevated one diopter; the left, three diopters. Fields showed a bilateral, predominantly nasal, loss. Vasodilators by mouth were prescribed.

On December 11th, vision was about 8/200, O.U., and both discs were still elevated, although the right disc was pale and the right retinal veins no longer engorged. The fields had widened out, with bilateral central scotomas. On December 17th, the right disc was flat and pale, and the left disc was elevated, although mini-

mally, and it was still slightly hyperemic.

Since the patient's vision was 8/200, he was started in sight-saving classes after the Christmas holidays. On January 24, 1946, however, his vision in the right eye was 20/20 and 4-point type; in the left eye, 20/100 and 9-point type. Both discs were pale, the left more so than the right, and Bjerrum fields showed only questionable peripheral constriction on the left. On February 7, 1946, vision was: R.E., 20/20 and 3-point type; L.E., 20/50 and 4-point type (slowly). The boy has been returned to regular school.

A physical examination, neurologic and ear, nose, and throat work up, urinalysis, complete blood count, serology, tuberculin test, throat cultures, X-ray studies of the skull, optic foramina, and of the long bones for lead were all negative insofar as revealing any possible etiology for the case. This case probably fits into the category of optic neuritis of unclassified type reported by Clay and Baird before the Section on Ophthalmology at the 1937 A.M.A. convention.

PARKES-WEBER-OSLER-DIMITRI SYNDROME

DR. C. KEITH BARNES presented the case of Miss M. H. This 41-year-old white woman had an extensive history, including pulmonary tuberculosis with a right thoracoplasty which was probably coincidental and had no relation to her ophthalmic problem. The history also included many years of violent and recurrent digestive upsets, variously diagnosed as food poisoning, bilious attacks, ptomaine poisoning, and so forth. She had had an episode of convulsions at the age of eight. She had been troubled with headaches, all her life. These had been particularly severe during the past 16 years. The headaches were accompanied by brilliantly colored light sensations, fortification spectra, and brief blacked-out epi-

sodes, and they occurred not infrequently during sleep as well as while she was awake.

Examination revealed a nevus flammeus of the left forehead and scalp, a faint intracranial calcification in the left occipital region, and a right homonymous, inferior quadrant field defect. There was also numbness of the right foot. In 1930, two oval yellow patches of uncertain nature were seen in the periphery of the left fundus; they had not been seen again. The patient is mentally alert but says her memory has been poor the past 15 years. The Schiøtz tenometer recordings were normal.

There has been no examination of the patient's relatives, but she reports that one cousin has a small birthmark over the inner canthus of one eye. Following a neurologic examination, her condition was diagnosed as a case of Parkes-Weber-Osler-Dimitri Syndrome, a condition closely related to the better known phacomias. The patient has received occipital irradiation, resulting in this epilation, with little relief. She routinely wears "Covermark" to conceal the port-wine stain, and is able to carry on her secretarial work.

DIABETES WITH CATARACT, RETINOPATHY, AND HEMORRHAGIC GLAUCOMA

DR. BARBARA SPIRO presented Mrs. T. Z., a 55-year-old white housewife, who was first seen in The University of Chicago Eye Clinic in consultation with the diabetic service. She had had poor vision in the left eye for the past two years with no other ocular symptoms; vision in the left eye was good. Although she had been on insulin therapy and a diabetic diet for only a few days prior to eye examination, the patient had known that she had diabetes for about 12 years.

Examination revealed her vision to be R.E., hand movements at eight feet; L.E., 20/25.

The lens of the right eye exhibited the picture of a mature cataract. The fundus could not be visualized through the dense lens. The left lens was fairly clear, but the left fundus revealed a moderate diabetic retinopathy.

Since vision of the left eye decreased fairly rapidly to 20/100 because of a developing cataract, a right extracapsular cataract extraction was performed about one year after the patient was first seen in the Eye Clinic. The diabetes was well-controlled and patient's postoperative course was uneventful. Her aided vision, postoperatively, was 20/200, this comparatively poor vision being due to a considerable diabetic retinopathy.

The patient was well satisfied with this modest result and her course was uneventful until she developed a 3 mm. hyphema six months after the cataract extraction. In spite of large amounts of vitamins and bed rest, the hyphema did not decrease. After about two months, tension in the right eye registered 28 mm. Hg in spite of miotics. The patient experienced no ocular pain or headache at any time. After about two months' duration of the hyphema, rubeosis iridis developed in addition to the hyphema; slowly the blood became organized and the iris lost its normal pattern. The patient now has the full picture of a hemorrhagic, but painless, glaucoma associated with diabetes.

CORNEAL DYSTROPHY

DR. BYRON L. GIFFORD presented a case of Dystrophia Corneal Granulosa (Buckler's, 1938; formerly Fleischer's type). The patient, Mrs. F. I., aged 27 years, was seen in the clinic October, 1945, complaining of moderate, but relatively constant, pain in the left eye for the past six months, and similar pain in the right eye for the past two months, bilateral tearing for bright lights, and occasional

frontal headache after reading. Corrected vision was: R.E., 20/20; L.E., 20/13.

Slitlamp examination showed the corneas of both eyes to have numerous, scattered, white bread-crumbs opacities. The irregular-shaped opacities were estimated to be about 0.1 mm. to 0.4 mm. in diameter. They were well distributed over the central cornea, but there was an uninvolved peripheral ring of clear cornea measuring 2 mm. in width. The bodies of the opacities appeared to be flattened against Bowman's membrane, but the fine fingerlike projections involved the anterior one third of the stroma. There was a marked loss of corneal sensitivity. No corneal vascularization was seen. Other examinations of the eyes revealed no abnormal findings. Four brothers, two sisters, father, and mother had no history of eye disease. Some of the eye symptoms were relieved by a change in correction.

SCIENTIFIC PROGRAM

RETINAL VASCULAR LESIONS

DR. JONAS A. FRIEDENWALD, Baltimore, Maryland, gave the second annual Sanford R. Gifford Memorial Lecture. His subject was: "Disease Processes versus Disease Pictures in the Interpretation of Retinal Vascular Lesions."

Robert Von der Heydt.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

February 21, 1946

DR. BURTON CHANCE, *chairman*

FLUORESCENT COLORS IN TANGENT SCREEN EXAMINATION

DR. JACOB B. FELDMAN and HAROLD J. ABRAHAMS, PH.D. (by invitation) presented a paper on this subject.

COMPLETE UNILATERAL OPHTHALMOPL GIA DUE TO PRIMARY CARCINOMA OF THE SPHENOID SINUS

DR. I. S. TASSMAN presented a case of complete unilateral ophthalmoplegia due to primary carcinoma of the sphenoid (orbital apex—sphenoid fissure syndrome) with involvement of the structures passing through the sphenoid fissure and optic canal and including the right ethmoid and right maxillary sinus and without involvement of the inner walls of the orbit.

The patient, a 58-year-old woman with a history of having had severe headaches for several years, was admitted to the medical ward at Mt. Sinai Hospital for study. Several days before admission she had marked epistaxis. She suddenly lost vision in the right eye four days after admission. Within two days there was complete ophthalmoplegia and ptosis of the right eye.

After complete studies and an exploration of the right orbit, a review of the X-ray films revealed a destructive lesion involving the sphenoid sinus. An extensive right sphenoidectomy, ethmoidectomy, and antrotomy through the nasal approach was performed.

Histologically the tissues from sphenoid sinus, ethmoid, antrum, and nasal mucosa were all reported as having a definite malignancy resembling carcinoma. Although primary malignancy of the sphenoid sinus is rare with only about 42 cases having been reported, in this case the carcinoma must be seriously considered as primary in the sphenoid sinus.

Most cases recorded in the past were incomplete in their manifestations and described under various names, the most common of which was orbital apex-sphenoid fissure syndrome. The writer feels the name of the syndrome should be more specific and descriptive of the symptom complex, which results from

a morbid process involving the sphenoid fissure and the optic canal with the structures they contain; hence, the name, "S-O syndrome with complete ophthalmoplegia."

DR. BENJAMIN H. SHUSTER gave further details of this case. He said that his first association with this patient was when he made a routine ear, nose, and throat examination at which time he found nothing of interest. He saw the patient again a week later during an episode of epistaxis. There was nothing at this time to indicate anything but a local area of bleeding. The nose was packed and the bleeding controlled. One week later, bleeding from the nose recurred, and he again saw the patient. At this time there was also present a marked paralysis of the ocular muscles. However, there was some reaction of the pupil to light.

Not being familiar with the specific nomenclature of the sphenoid-fissure syndrome, he had groped for an anatomic diagnosis. The vestibular (caloric) test did not reveal any sign of an intracranial lesion. Aside from the ocular immobilization, there were no signs of any mass in the orbit. The presence of the pupillary reaction to light pointed against the possibility of a brain-stem lesion which would also have to be extensive to involve the number of nerves concerned. There were no systemic signs of cavernous-sinus thrombosis. Edema and ecchymosis which are found in this condition were not present. The situation seemed to resolve itself into a possible small hemorrhage at the apex of the orbit incompletely compressing the nerves, or a growth in the sphenoid sinus encroaching slowly upon the contents of the cavernous sinus adjacent to its lateral wall. This could compress the nerves and yet permit some venous blood to pass through preventing the occurrence of edema and ecchymosis. A specific request was made for orbit and

sphenoid sinus X-ray films. These were misinterpreted, and the sphenoid was pronounced negative.

It was decided to explore the orbit through an incision at its medial boundary. If an erosion was found on the nasal wall, it could be followed through. No such break was found, and in view of the negative sphenoid-sinus report, no further search was made. The possibility of an intracranial lesion had to be considered. Shortly after the operation, the films were again studied and the conclusion was reached that the sphenoid as well as other sinuses were involved. Accordingly, it was decided to research the wound with the idea of breaking through to the sinuses, and an attempt to reach the sinuses, nasally, was first made.

When a sphenoid probe was introduced, there was immediate indication that the posterior sphenoid bony wall was destroyed. The nose at first appeared to be normal, but after breaking down the bony covering, a mass of malignant-appearing tissue was seen in the sphenoid, ethmoid, and maxillary sinuses. Microscopic study of this tissue showed it to be malignant. He believed that Dr. Tassman was correct in his contention that the primary growth was in the sphenoid. The vague headache and the bulk of the mass in the sphenoid pointed in that direction. Those who have seen some of the cases of malignancy of the antrum will agree that, in the length of time the condition existed in this patient, the orbit would have been invaded much sooner and not in a fashion of involving the nerves, but rather of involving the entire intraorbital contents.

The orbital incision employed in this case was routine for extranasal exenteration of the sinuses. It afforded a very satisfactory exposure of the orbit in its floor, median wall, and roof.

DR. HENRY A. SHENKIN said that the neurosurgeon's interest in this patient

rested in the possibility of an intracranial lesion producing this syndrome, particularly a tumor of the sphenoidal ridge. Unquestionably, the outstanding point in the differential diagnosis was the fact that a sphenoidal-ridge meningioma is a very slow-growing lesion, the symptomatology being gradually progressive over a period of years or, at least, for many months. For the same reason, the external ocular muscle involvement is rarely complete, the slow-growing lesion distorting but not completely interrupting the nerves passing through that region.

There may be blindness from a sphenoidal meningioma. He believed that at least 25 percent of cases have severely impaired vision, but this will usually be accompanied by primary optic atrophy, resulting from the length of time the optic nerve has been under pressure. Carcinoma of the sinuses may cause exophthalmos, which is also an outstanding feature of sphenoidal-ridge meningioma. X-ray studies would reveal hyperostosis of the orbital roof and of the sphenoidal wings in the latter. In such exophthalmos, the optic bulb would tend to be depressed due to exostosis of the orbital roof. Malignancy of the sinuses will be accompanied by erosion of the bones of the orbital cavity, and bones nearby.

DR. I. S. TASSMAN (in closing) said that cases of this kind were very unusual. This patient came to his attention because of the ocular condition while she was on the medical service under treatment for vascular hypertension. As Dr. Shuster pointed out, it was logical to enter the orbit on the medial aspect so that it would be easy to enter the sinuses at the same time if this appeared to be indicated. Strangely enough the orbital walls were found to be perfectly normal, and the nasal sinuses gave no evidences of the presence of any disease.

In spite of this, he strongly suspected

trouble in the sinuses even prior to the orbital exploration especially because of the chemosis of the conjunctiva. The possibility of a retro-orbital pathologic condition was also considered seriously, and it was recognized that there was pressure present to produce the congestion and chemosis. However, all this time there was no exophthalmos in the right eye. He believed that this was important evidence to eliminate an intraorbital or retro-orbital growth. Although it was recognized that the second, third, fourth, ophthalmic branch of the fifth, and the sixth nerves were involved, the etiologic factor was obscure until the time of operation. For this reason and because of the infrequency of reported cases, it was felt that this case should be recorded.

TENDON TRANSPLANTS FOR PARALYSIS OF THE EXTERNAL RECTUS MUSCLE

DR. EDMUND B. SPAETH presented moving pictures of the operation of tendon transplant from the superior and inferior rectus muscles for the correction of paralytic strabismus involving the external rectus. He emphasized the advisability of employing this surgery only in those cases wherein the paralytic eye can be moved spontaneously up to the midline. In those cases in which the eye remains in paralytic convergence, this surgery can accomplish no more than an ordinary recession of the internal and resection of the paralytic external rectus. In properly selected cases 15 to 30 degrees of external rotations have been achieved following the surgery. The principles underlying the surgery are two-fold. The first is a definite release in the paralytic convergence by the recession of the internal rectus and, through the use of the tendon transplant from the superior and inferior rectus muscles, cutting internal rotations ability by half. Secondly, the transplant holds the eye into eyes

front or even in the slight latent divergence, permitting the two obliques to function more adequately as external rotators. The receded internal rectus furnishes adequate convergence for near work. The surgery has its best indication where there is an acquired paralysis of the external rectus, rather than in cases of congenital palsy.

DR. LOUIS LEHRFELD said that Dr. Spaeth might recall the exhibit of two cases of the Hummelsheimer operation by him at the Wills Eye Hospital Conference several years ago. One of the patients concerned with the exhibit was seen at the Wills Hospital Clinic recently. The result was quite excellent.

There was a slight difference in the technique compared with that just shown. Instead of transplanting the sections of the tendon of the superior and inferior rectus muscles above and below the insertion of the external rectus muscle, Hummelsheimer recommends that the tendon transplants be inserted under the

insertion of the external rectus muscle.

Dr. Lehrfeld thinks that the key to success of such muscle-transplant operations rests with a firm anchoring of the transplanted tendons to their new positions. He found that this could be best accomplished by the use of silk sutures inasmuch as they are unabsorbable.

Last year he used the Hummelsheimer technique in operating on a patient who had paralysis of the superior rectus muscle associated with ptosis. To his surprise he not only obtained a fair result in restoring partly the function of the superior rectus muscle, but also obtained a reduction in the amount of ptosis.

He said that he hoped Dr. Spaeth's presentation would stimulate the surgeons present to resort to this method of tendon transplant not alone in external-rectus paralysis, but in paralysis of all the ocular muscles.

George F. J. Kelly,
Clerk

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NUTRITIONAL AMBLYOPIA (JAPONICA)

In this number and in the October, 1946, issue of the Journal are to be found reports by competent observers of cases of amblyopia in prisoners of war due to nutritional optic neuritis. These poignant papers deserve an editorial spotlight not only because they add much to our knowledge of ocular complications of avitaminosis but also because the unfortunate subjects of the afflictions were the victims of the cruel beastliness of our enemies.

There is some satisfaction in knowing that these reports will eventually be seen by present and future Jap and Hun ophthalmologists, who should never for one minute be permitted to forget that in these instances as in so many others they, the physicians of our enemy countries, violated every human feeling and law of our noble profession. We scorn and shall ever scorn them, because by their acts they have vitiated every advance in medicine for which they may have been responsible in the past, and

they have been traitors to the brotherhood of medical service to man.

American soldiers and civilians were blinded when they were helpless prisoners of war, not by shell fire, hand grenades, or bombs, but by lack of food that civilized and humane people would not withhold from a dog. They were not even given the benefit of the knowledge of the cause of their loss of sight, possessed by Jap ophthalmologists. For it was in Japan that cases of amblyopia and central scotoma due to beriberi were originally observed and reported in the world's medical literature. It makes bitter reading now.

Takaki, in 1884, in Japan was the first worker to recognize the dietetic nature of beriberi. Prior to his work this disease had been responsible for sickness in at least 25 percent of the Japanese navy's personnel. Takaki recommended replacing the rice diet in the Japanese navy by a mixed diet that included wheat bread, fresh vegetables, and milk. This resulted in the entire disappearance, by 1887, of the disease in the Japanese navy.

Professor Eijkman in Batavia in 1890 produced experimental beriberi in fowls by feeding them polished rice and cured it by giving them an alcoholic extract of rice polishings. Professor Grijns combined the work and came to the conclusion that beriberi was due to the absence of some essential ingredient from the food.

In 1907, Fletcher observed that the inmates of the Kuala Lumpur mental asylum who ate "uncured" polished rice came down with beriberi, while those who ate "cured," that is parboiled rice, escaped.

Fraser and Stanton, in 1909, performed significant, planned feeding experiments with Javanese laborers and showed that polished rice produced beriberi. Their observations were fully con-

firmed by Strong and Crowell (1912).

Cašimir Funk, working in the Lister Institute, isolated a protective substance from the rice polishings in 1911 and introduced the word "vitamine." Pure crystalline vitamin B₁ was chemically identified in 1926 by Jensen and Donath and was synthesized by Williams and his co-workers in 1936.

In 1909, H. Yamaguchi of Tokyo, Japan, reported in the *Klinische Monatsblätter für Augenheilkunde* (Volume 47, part 1, page 517) a case of retrobulbar optic neuritis due to beriberi (Kakke). The patient with general signs of the condition, chiefly edema of the extremities and polyneuritis, developed, within a few months, a central scotoma in each eye without observable fundus changes. He was treated with diuretic agents and moderate feeding, which was successful in clearing up the scotomas in a month. The author reviewed the Japanese literature and cited the experiences of Kono (1895), Komoto (1898), Tsurumaru (1899), Komoto and Aoki (1901), Yamamoto (1901), and Ichihara (1902), all of whom reported cases of loss of central vision due to beriberi. Ichihara's resume (1904) was as follows:

(a) Amblyopia and visual field changes may appear as prodromal signs two or three months before the development of the general disease.

(b) The loss of sight in beriberi occurs in badly nourished people.

(c) The amblyopia and visual-field changes in beriberi are of a temporary nature (sic).

(d) An atrophy of the temporal nerve fibers in the papilla is often found.

(e) The loss of sight in beriberi is similar to that in alcohol-tobacco-lead poisoning.

The controversy between those who believed in infection as a cause and those who believed in a toxin (in rice or fish)

as a cause is no longer an issue. Yamaguchi thought that the toxic theory (poisoning with rice, fish, and so forth) was the most acceptable. We know now, thanks to Bloom, Merz, Taylor, Roberts, Willcockson, Carroll, and others that vitamin B₁ (thiamin-chloride) deficiency is to blame.

We see, therefore, that the lack of vitamin B₁ in polished rice and its presence in quantity in the polishings of rice have been common and world-wide knowledge for many years prior to the war. Bloom, Merz, and Taylor cite an instance where in a Japanese prison camp "the rice polisher broke and unpolished rice was served for two months. A definite improvement in the condition of the men resulted during this time. On returning to the diet of polished rice, they suffered a recurrence of former symptoms."

How infinitely sad it is to consider the great and permanent evil that resulted from the criminal negligence of the Japanese medical authorities, especially ophthalmologists, in not insisting that unpolished rice, unpalatable as it may be, be given the prisoners of war. There is no evidence that any Jap physician ever ordered prisoners to be fed unpolished rice, although all could not have been ignorant of the experiments and studies that had been performed in their own country and elsewhere in the East prior to the war; or advised the commanding officer of a prison camp not to use his rice-polishing machine; or suggested that rice polishings or rice bran or Tikitiki (an extract of rice bran) be furnished the prisoners as a supplement to their terribly meager and filthy rations; or gave instructions to the prison cooks on how to parboil rice in order to spare the vitamin B₁ contained therein. This is the crime of all ophthalmologists living in Japan today.

Pioneers in the study of visual loss in

beriberi, possessed of knowledge on how to prevent this avitaminosis and how to treat it early enough to prevent permanent or irreversible changes in the optic nerve, they withheld in their hour of triumph even the lowly polishings of rice, polishings that were no doubt discarded, from their helpless and sick victims. They shall ever stand condemned.

Derrick Vail.

THE ABSTRACT DEPARTMENT

Rare indeed must be the ophthalmologist who is able to read or even to scan the whole field of ophthalmic literature in his own and other languages; to say nothing of the many excellent papers dealing directly with ophthalmology, or having some relation to it, which appear in general medical journals or in the journals of other specialties. A good abstract department undertakes to bring to the busy reader some sort of indication of the contents of the world's literature in regard to ophthalmology.

There are few ophthalmologists who read their medical magazines through from cover to cover. The longer a medical essay, the more likely it is to be skipped through, or perhaps even to be read only as to its concluding summary. The medical essay which presents no summary is particularly apt to be neglected by a large number of readers. A leading ophthalmologist of the United States once told the present writer that the first things he looked at upon arrival of the American Journal of Ophthalmology were the editorials and the Abstract Department.

Jackson's *Ophthalmic Year Book*, in its fuller development, aimed to present each year an organized survey of the world's ophthalmic literature, grouped under special headings. The Year Book was never placed upon a sound financial basis, and after many years was abandoned as

insufficiently appreciated and too expensive for continuance out of the founder's personal resources. The Abstract Department of the American Journal of Ophthalmology, approximately in its present form, was organized to offer, as far as possible, a satisfactory substitute for the Year Book.

From time to time, many criticisms of the Abstract Department have been offered. In the maintenance of the Department a number of factors must be considered. One is the ever mounting cost of publication. Some readers demand long abstracts, some short. The organization of a large corps of voluntary workers presents its own difficulties. Some busy ophthalmologists succeed in doing remarkably prompt and efficient literary work, in spite of the demands of office practice and attendance at clinics. Some abstracters show more tendency than others to drop behind in the abstract work, and must therefore be appealed to by correspondence more frequently than their colleagues. Some have less readiness in literary expression and their material therefore consumes a larger amount of the abstract editor's time and effort. Then the abstracts must be classified with care. Often the original article cannot be dealt with rigidly under one classification, and, to avoid repetition in a different section, must be given a cross reference in order best to serve the purposes of the reader who is looking up a group of papers on some special topic.

No doubt some casual readers have wondered why it was necessary to mention in the Abstract Department the titles of original papers published in the American Journal of Ophthalmology. This is to meet the convenience of authors or investigators who wish to assemble groups of references from the Abstract Department; because otherwise such an investigator or his assistant or secretary

might easily overlook the Journal's own original papers.

Now and then we hear from ophthalmologists who think that we should omit abstracts of papers dealing with rather trite or insignificant material. However, it must be remembered that to readers in small and remote communities the material furnished by these less outstanding medical reports and essays may carry valuable information and professional stimulation.

A world war brings problems in periodical medical literature as well as in other fields. During World War II the Abstract Department was deprived of access to a number of foreign eye journals. In that period we tried to make up in part for the deficiency by giving somewhat greater space to English-language publications. Now that the war is over, on the other hand, we are faced with the formidable problem created by the receipt of considerable numbers of foreign journals which appeared with more or less regularity (strange as it may seem) during the war, and editorial and publishing organizations look somewhat aghast at the heavy demands made for space by the editor of the Abstract Department. This special difficulty will naturally pass when our abstracters have had time to catch up with the accumulations.

A last, and quite important problem, is the occasional tendency of editors to feel that they cannot keep on forever but must turn over their duties to new hands. Our Abstract Department is extremely fortunate in having found, in Dr. F. Herbert Haessler, a new editor who, in spite of his regular professional engagements, is devoting himself with courage and skill to this new responsibility.

W. H. Crisp.

BOOK REVIEWS

APPLICATIONS OF GERMICIDAL, ERYTHEMAL, AND INFRARED ENERGY. By Matthew Luckiesh, D.Sc., D.E., Director, Lighting Research Laboratory, General Electric Company, Nela Park, Cleveland. New York, D. Van Nostrand Co., Inc., 250 Fourth Avenue, 1946. Clothbound, 463 pages, foreword, contents, references, index. Price \$5.50.

This delightful book deals, to quote the author, "primarily with some major effects of radiant energy and with applications that are bound to be extensive." It represents the accumulation of studies carried out over 30 years or more of association with the research laboratories of the General Electric Company, a laboratory, to quote from the writer, "with the usual personnel, but with a unique character. Its only obligation was to obtain and publish new knowledge of various aspects of light and radiant energy."

The titles of the first few chapters give a clue to the objectives and general tenure of the report: Challenging the Sun, Sunlight and Skylight, Erythema and Tan, Units and Terminology for Biological Effectiveness, and Germicidal Energy.

The author states, concerning the subject matter of the book, that, "The value of much of the published material is greatly reduced by the absence of accurate measurements and adequate identification of the spectral distribution of energy. . . . There is need for closer coordination of the knowledge of physical science with that of biology, medicine and therapy, in the various realms of education, research and practice." The author and his colleagues have made a specialty of developing measuring devices and techniques. "The results provide a major reason for writing this book."

The subject matter is approached from

the layman's point of view. Complicated formulas, both mathematical and otherwise, are studiously avoided. Yet the necessary terms and symbols are adequately explained and in logical sequence. There are rather frequent repetitions of similar ideas and principles in different chapters of the book, so that each may be read almost as a separate thesis in itself. The entire work is profusely illustrated by simple and easily comprehended graphs, tables, and plates.

The first chapter lays an excellent groundwork for what is to follow. In it, a spectroscopic analysis is made of sunlight and the means for its reproduction from artificial sources are indicated. The challenge to the sun is shown to be real indeed, in that certain beneficial spectral waves of great germicidal potency entirely absent from sunlight, such as those having a wave length of 2,537 angstrom units, can easily be produced by artificial means. It is also demonstrated how, by selection of various filtration media, undesirable wave lengths can be removed, such as those producing erythema when tanning alone is desired, or vice versa. Throughout the entire work, as previously indicated, an effort has been made to standardize the terminology and to develop yard sticks, so to speak, by which definite quantitative analyses can be established. The author feels that only by such definite terminology can scientific advance be accomplished. Much of the fourth chapter is devoted to a definition of terms, both established and suggested. Other chapters follow, dealing with the Disinfection of Controlled Air, the Infection of Communal Air, and methods for Disinfecting Air in Occupied Interiors. Emphasis is placed upon the necessity for satisfactory equipment to carry out accurate analyses of bacterial content of the air under consideration, and much detail in the description of such apparatus is

given. The treatment of water follows in succeeding chapters, with an interesting analysis of those factors which render it more or less susceptible to treatment by germicidal lamps.

Artificial sunlight and daylight for indoor illumination is considered, and its very practical application is demonstrated. The commercial aspects of such types of illumination, as shown by the fading of materials, is not overlooked; nor is the effect upon plant life and the analogy between that and the welfare of human beings neglected. The reflection and transmission of various substances is discussed and the suitability of these substances for various purposes is indicated, in the light of these findings.

One of the closing chapters enters into a rather detailed and technical description of apparatus for analyzing and measuring ultraviolet energy. The final chapter restates the thesis that, "The primary purpose of this book is to provide a scientific basis and technology for certain major uses and effects of ultraviolet energy." It proceeds to review briefly the various applications of radiant energy in the light of the scientific basis and technology expounded throughout the entire treatise.

The book is well-written in a most attractive style. It deals with subject matter of vital and rapidly growing interest to the ophthalmologist and will amply repay repeated, careful perusal, even though the author has given only passing reference to the effect of light of various wave lengths upon the eye. This omission is readily understood, as such a discussion would obviously be rather outside the scope of the present work. The makeup

of the book, print, paper, and binding leave little to be desired.

M. Hayward Post.

CIRUGIA OCULAR. By H. Arruga. Barcelona, and Buenos Aires, Salvat Editores, S. A., 1946. 845 pages, 1218 illustrations of which 119 are in color, index, bibliographies. Price unknown.

A magnificent and authoritative volume of ophthalmic surgery by one of the world's masters of the art is always a rare event of the first magnitude in our literature. This book, dedicated to his colleagues by the author and printed in Spain, leaves one spellbound over the beauty of its pages and its illustrations (the color plates are especially fine), and envious of the extent of the author's knowledge and skill in the presentation of the text. Those of us who read Spanish, even if a little, have but slight advantage over those of us who don't for the illustrations speak for themselves. The chapter on Detachment of the Retina is especially excellent as one would expect of the author, but all of the chapters are splendid and thorough and cover the entire field of ophthalmic surgery from the layout of the operating room and care of the instruments to definitive descriptions of all modern procedures including plastic surgery. The references are modern and up-to-date, and it is pleasing to note that so many are to North- and South-American authors. The author and his publishers are to be congratulated and honored by our gratitude for this outstanding addition to our surgical knowledge.

Derrick Vail.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

1

GENERAL METHODS OF DIAGNOSIS

Arruga, H. A note on the Schiötz tonometer. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1964, v. 6, Jan., pp. 85-86.

Arruga designed a scale, which is attached to the Schiötz tonometer, and which indicates the intraocular tension for each division on the Schiötz scale. This does away with the necessity of consulting the tension chart accompanying the tonometer. Each instrument must be calibrated individually. (2 illustrations.) Ray K. Daily.

Arruga, H. The annoying reflexes of the opening in the ophthalmoscope. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Aug., p. 701.

In indirect ophthalmoscopy with intense illumination one is at times annoyed by disturbing reflexes from the central hole of the ophthalmoscope. These can be eliminated by covering the edge of the hole with soot from a burning match. Ray K. Daily.

Carlevaro, Gianfranco. Proposal for a unified scheme of examination of the ocular functions. *Riv. di Oftalm.*, 1946, v. 1, pp. 28-33.

To make ophthalmologic findings comparable and reproducible, particularly for medico-legal purposes, the author proposes a specified scheme concerning the routine examination of the visual functions. K. W. Ascher.

De Ment, J. The ultra-violet ophthalmoscope. *Brit. Jour. Ophth.*, 1946, v. 30, June, pp. 370-372.

The author describes an ultra-violet reflecting ophthalmoscope of his own design and predicts a much more widespread use of this instrument. In sudden death there is a change of the normal bright green luminescence of the fundus to a dull blue and cataractous lens material emits a different hue from the surrounding tissue. Neoplasms and other diseased tissues often fluoresce differently from the normal. Morris Kaplan.

Gormaz, A. An exophthalmometer for direct measurement. *Brit. Jour. Opth.*, 1946, v. 30, June, pp. 350-353.

An exophthalmometer of transparent plastic is described. It consists of three vertical stems that slide on a horizontal millimeter scale. In use the two outer stems are adjusted so that their grooved ends can be placed on the bony orbital margin while the central stem, which also slides across a horizontal bar and ends in a small cup, rests directly on the anesthetized cornea as in a tonometer reading. The instrument is simple, inexpensive and apparently accurate. (3 illustrations.) Morris Kaplan.

Lopez, A. A. A chart for the examination of the blind spot. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Aug., pp. 698-700.

A chart similar in type to the one used on a stereocampimeter is placed in a movable holder attached to the arm of a perimeter. With the central fixation target used for fixation, the blind spot is outlined with a 3-mm. testobject on the chart. (Three illustrations.) Ray K. Daily.

Lopez, A. A. An easy and rapid method for measuring heterophoria. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Aug., pp. 697-698.

The author's device consists of a sheet of black paper, with a series of round perforations 1 cm. in diameter, separated by a distance of 29 mm. Viewed from a distance of five meters the distance between two perforations represents $\frac{1}{3}$ of a degree. By placing a vertical prism in front of the right eye, and a red glass in front of the left, two lines of perforations are seen and the extent of the lateral deviation is easily

calculated from the number of displaced perforations. Ray K. Daily.

Maione, Mario. Theoretic foundations, limits, and practical value of physiologic photometry (with criteria for correcting a photometer). *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 73, Jan., pp. 33-57.

The author discusses at length the problem of photometry in its physical and physiologic aspects and indicates the conditions which should be observed for attaining the greatest possible accuracy in physiologic photometry. In his studies he employed a Maggiore photometer (now in process of production), which, being furnished with a photo-electric cell, makes for greater objectivity.

Harry K. Messenger.

Syz, Hans. The Lifwynn eye-movement camera. *Science*, 1946, v. 103, May 17, pp. 628-629.

A camera is described by means of which the sequence of eye movements and the duration of fixations may be registered. The camera uses standard 35-mm. motion picture film. The frames are changed automatically once each second, and exposure frequency of 5. to 30 per second is provided for, but this could easily be increased to 60 or more if desirable. The accuracy of the time intervals between exposures is reliable and is achieved by an electrically controlled stroboscopic device. (References.) F. H. Haessler.

2

THERAPEUTICS AND OPERATIONS

Arruga, H. Privin in ophthalmology. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Aug., pp. 673-675.

Arruga finds 0.1 percent privin supe-

rior to adrenalin, in that it produces a vasoconstriction lasting longer than that of adrenalin and without subsequent vasodilatation. He uses it in surgery as a hemostatic instead of adrenalin, and therapeutically in all types of chronic conjunctivitis without secretion and with pronounced subjective symptoms, such as allergic and chemical conjunctivitis, and the type secondary to lacrimal obstruction.

Ray K. Daily.

Barraquer Moner, J. I., and Deó Rídruejo, J. M. Contribution to the study of penicillin therapy in ophthalmology. Arch. med. quir. y del trabajo, 1946, Jan.

The authors report the results obtained in the treatment with penicillin in twenty-eight patients with ocular disease. They briefly describe the micro-organisms that are sensitive to penicillin. They record eight clinical histories of patients in whom penicillin was used parenterally. They believe that their results surpass those of other authors.

Jose Saenz Canales.

Brückner, R. The effect of histamine on the eye. Ophthalmologica, 1946, v. 111, April-May, pp. 306-309.

The severe chemosis that follows the instillation of histamine is prevented when anesthetics are used beforehand. This fact was demonstrated by the author in numerous experiments with rabbits. It also explains the negligible reaction when histamine is used as a miotic after intracapsular cataract extractions.

Alice R. Deutsch.

Campos, Evaldo. Tuberculin therapy in ocular tuberculosis. Rev. Brasileira de Oft., 1946, v. 5, Sept., pp. 37-42.

This is a brief statement of the author's own practice in the use of tuber-

culin. He uses relatively substantial doses. The initial dose is 0.05 or 0.1 c.c. of 1 to 1000 Koch's Old Tuberculin, intradermally; repetitions are usually given in the muscles. In the absence of general reaction the dose is doubled, and subsequent doses are usually increased each time by 0.2 c.c. of the same solution until the bulk of the solution indicates the use of 1 to 100 old tuberculin. The interval between doses is four or five days. The previous dose is repeated or the dose diminished whenever appreciable reaction occurs. A few cases are briefly cited.

W. H. Crisp.

Dunphy, E. B. Medical progress: ophthalmology. New England M. J., 1946, v. 235, July, pp. 117-121.

This is an excellent summary of recent advances in ophthalmology stressing therapeutic improvements. Penicillin is shown to be superior to the sulfonamides as its antibacterial action is not inhibited by autolytic processes or secretions. It has little or no effects on the regeneration of the corneal epithelium. It is not incompatible with the drugs ordinarily used in ocular infections. When penicillin is applied locally by corneal bath, a much higher concentration is found in the conjunctiva, sclera, iris, and aqueous than when given either intravenously or subconjunctivally. The application under the lid of a small cotton pack saturated with a solution of penicillin containing 20,000 units per c.c. has been shown to be very effective in producing high concentrations in the aqueous, cornea, and iris. Intramuscular and intravenous injections of penicillin probably have little effect in the vitreous chambers. Subconjunctival injections may have some effect in the anterior chamber but probably none in the vitreous.

Infections of the vitreous can probably be best treated by a single intravitreal injection of penicillin solution containing not more than 500 units. Infections of the anterior chamber require local applications by means of cotton packs. Corneal baths and subconjunctival injections are probably less effective.

Dramatic improvement has followed injections of penicillin into the anterior chamber for infections following perforating injuries. A single injection of 100 units has usually been sufficient.

A. G. Wilde.

Juler, F. and Johnson, G. T. Use of crystalline penicillin in corneal and intraocular infection. *Brit. Jour. Ophth.*, 1946, v. 30, April, pp. 204-208.

The use of crystalline penicillin massaged into the crater of a corneal ulcer is described. The pure drug was carefully rubbed into the tissue of advancing edges, massaged well into lips of cataract sections or applied to the trephine bleb in postoperative infection. Results were much better than usual and most notable was the clarity of the scars resulting from the ulcers. In one eye the drug was injected into the aqueous. Five case reports are presented. Despite many impurities in the powder, it dissolved very rapidly and there were no untoward effects.

Morris Kaplan.

Leopold, I. and Comroe, J. Effect of diisopropyl fluorophosphate ("DFP") on the normal eye. *Arch. of Ophth.*, 1946, v. 35, July, pp. 17-32.

The authors report detailed technical research of the effect of this drug on the normal eye. Diisopropyl fluorophosphate "DFP" locally instilled in the eye in low concentrations will produce prolonged miosis, ciliary spasm, false myopia, and decrease in intraocu-

lar tension. Quantitative species variations were found to exist, but the effects were most marked and prolonged in man. A 1-percent solution of "DFP" produced more prompt, pronounced, and prolonged miosis than a 5-percent solution of neostigmine bromide. "DFP" in the concentrations used has no direct effect on the iris muscle itself, since it failed to constrict the totally denervated cat iris. Its effects, therefore, are due entirely to inactivation of cholinesterase. A 0.1-percent solution of "DFP" was able to overcome the cycloplegic effect in human eyes of 4-percent homatropine hydrobromide, and a 0.2-percent solution of "DFP," that of 1-percent atropine sulfate.

No significant difference could be demonstrated between oil and water as a vehicle for "DFP" for ophthalmic use except that "DFP" is decidedly more stable in peanut oil than in water. (References.) R. W. Danielson.

Mayer, L. L. Use of penicillin ointment in external ocular conditions. *Arch. of Ophth.*, 1946, v. 35, June, pp. 688-689.

This is a preliminary report on the use of an ointment containing 1,000 units of calcium penicillin per gram combined with 1:10,000 merthiolate in 100 patients with various external ocular infections. No patient with chronic conjunctivitis was benefited. Usually infected hordeolum subsided in from three to four days without incision. In cases of chalazion the infection subsided in from four days to one week but it was usually necessary later to incise and curet the gland. Nonpurulent acute conjunctivitis failed to respond to the penicillin ointment. Acute purulent conjunctivitis was cured in from three to five days. It was noted

that superficial infections of the skin around the lids cleared dramatically with simple application of the penicillin ointment to the surface of the skin.

John C. Long.

Meyer-Hartman, W. M. The thermal treatment of rheumatic diseases with special considerations of the springs of Baden. *Ophthalmologica*, 1946, v. 111, April-May, pp. 229-241.

The anatomy, etiology, distribution and the treatment of the rheumatic diseases are discussed with special reference to Hochrein's and Huch's classification.

The effect of mineral baths on the organisms and their importance in the treatment on rheumatism are described. The springs of Baden and the routine procedures for beneficial therapy serve as an example. Alice R. Deutsch.

Minton, Joseph. Penicillin in treatment of common external eye infections. *Brit. M. J.*, 1946, no. 4470, Sept. 7, pp. 324-326.

This agent is recommended in children having the more common external infections such as blepharitis, conjunctivitis with or without corneal ulceration, and infection of the lacrimal sac.

In either adults or children an allergic dermatitis may occur following any form of local penicillin therapy and the etiology can be verified by means of the patch test. In the preparation of the ointment, water should not be used as it reduces the stability. The penicillin is not soluble in the fatty base, but when applied, the moisture of the skin or tears will slowly dissolve the penicillin, and thus prolong its action.

A. G. Wilde.

Rønne, Gerhard. Local treatment of intrabulbar infections. *Brit. Jour.*

Ophth., 1946, v. 30, July, pp. 405-419.

Rønne found that 0.2 c.c. of penicillin solution containing 100 to 500 units could be injected directly into the vitreous without great danger and with great benefit. Its effectiveness depends on the concentration of penicillin maintained in the vitreous. A bacteriocidal concentration should be maintained for at least 16 to 24 hours. Although staphylococci were used in this experiment, Rønne believes the drug is equally efficacious against all the bacteria that are sensitive to penicillin. (Bibliography.)

Morris Kaplan.

Rosen, Lucien. Administration and indication of Priscol in ophthalmology. *Ophthalmologica*, 1945, v. 110, Sept.-Oct., pp. 191-205.

Priscol "Ciba" (chlorhydrate of 2-benzylimidazoline) is a vasodilator and is available in the form of eye drops, a solution to be injected, and a 10-percent ointment.

The medicament can be given whenever an active hyperemia is desired. Particularly good results were achieved in the treatment of parenchymatous keratitis, nonmyopic changes in the vitreous body, blockage of the central artery of the retina, migraine, optic neuritis, and glaucomatous atrophy of the optic nerve. Retinitis pigmentosa and certain chorioretinal conditions also were favourably affected. (References.)

F. Nelson.

von Sallmann, L., Grosso, A. E., and Marsh, M. G. Ophthalmic penicillin ointments. *Arch. of Ophth.*, 1946, v. 36, Sept., pp. 284-292.

Favorable reports have been made on the treatment of certain surface infections of the border of the lid, the conjunctiva, and the cornea with penicillin ointments. It was desirable to extend

the investigations and to compare the advantages of several ointment bases and penicillin compounds.

In the present study three properties of penicillin ointments were collated experimentally: first, their irritative action on the normal rabbit and human eye; second, the stability of penicillin in various bases at room and at refrigerator temperature, and third, the penetration of penicillin from the ointment into the eye.

The authors conclude that of the nine ointment bases that were tested, two were irritating to the eye. No irritation could be attributed to any of the four penicillin compounds that were incorporated in the ophthalmic ointments. The potency of the penicillin in the salves was relatively stable in one hydrous and two anhydrous bases after twelve to sixteen weeks in the refrigerator. Storage at room temperature usually resulted in a rapid loss of potency except for two ointments prepared with an anhydrous base. No difference in the stability of the various ointments could be ascribed to the penicillin compounds in the salves. The penetration of penicillin into the aqueous of rabbits from one hydrous and two anhydrous bases was substantial. After the application of two ointments with the calcium salt, the content of penicillin in the aqueous exceeded that of salves with the sodium and ammonium salts. The resorption of penicillin was unsatisfactory from the one ointment which contained the free acid of penicillin.

R. W. Danielson.

Tomai, Evandro. The immobilization of the eyeball. *Boll. d'Ocul.*, 1945, v. 24, Jan.-March, pp. 58-60.

The author describes a blepharostat furnished with a special device by which the eyeball can be immobilized

in operations on its anterior segment. A needle with a silk suture is passed through the superior rectus tendon, the needle is removed and the two ends of the suture are clamped in the device that is attached to the upper branch of the speculum while the eyeball is gently pulled down to the desired position. (1 figure.)

Melchior Lombardo.

Valerio, M., and Blum, J. D. Studies on the mydriatic action of adrenaline drops. The effect of wetting agents. *Ophthalmologica*, 1946, v. 111, April-May, pp. 193-219.

The authors discuss the pharmacologic action of adrenaline solutions in general, the physiology of the adrenaline mydriasis, and its advantages compared with other mydriatics. Their own research work shows that the mydriatic effect of adrenaline drops is independent of the individual sensitivity or concentration of the drug. It is the amount of the active substance at the neuromuscular junction of the dilator of the pupil that is essential. Isotonic solutions are less irritating. Isotonicity does not greatly influence the penetration, but added wetting agents do.

Local anaesthetics favor the penetration of adrenaline chiefly because they are wetting agents. Percaïne, which is a quinine derivate, surpasses the cocaine derivatives in this respect. The adrenaline mydriasis is more pronounced in the aged and is more easily achieved. A one pro mille adrenaline solution in five pro mille percaïne gave the best mydriasis without reduction of accommodation and caused a reduction of tension, especially in the hypertensive eye. This mydriasis resists the surgical opening of the anterior chamber but is eliminated by

eserine and amineglaucon. (References.)
Alice R. Deutsch.

Wolf, A. V. and Hodge, H. C. Effects of atropine sulfate, methylatropine nitrate (metropine) and homatropine hydrobromide on adult human eyes. Arch. of Ophth., 1946, v. 36, Sept., pp. 293-301.

In previous reports regarding the mydriatic and cycloplegic action of these drugs the solutions used varied in strength and the doses were not given. In this report conditions have been kept constant with one drop of 1 percent solution. Under these conditions homatropine had less mydriatic and cycloplegic effect than either of the other two drugs, and recovery from its effects was the most rapid.

Methylatropine nitrate had significantly less mydriatic action than atropine. The cycloplegic action was about the same as that of atropine.

R. W. Danielson.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Berens, Conrad. Ocular fatigue. Ophth. Ibero Amer., 1945, v. 7, no. 3, pp. 165-186.

The author describes nine clinical cases to illustrate the fact that various causes other than purely local conditions may contribute to the development of asthenopia. Persons in military service who suffer from asthenopia should be thoroughly studied in regard to questions of general medicine and neurology, as well as by a searching eye examination. The nine cases cited showed the following combinations: asthenopia associated with quadrant anopsia and paralysis of the superior oblique following an airplane accident; rapid fatigue of accommodation associ-

ated with chronic hyperplastic pansinusitis; asthenopia in an aviator associated with paresis of convergence and accommodation; asthenopia associated with convergence insufficiency secondary to sinusitis; diet as a probable cause of asthenopia associated with fatigue of accommodation and convergence; rapid effect of oxygen deficiency in a patient with subnormal accommodation and convergence; aniseikonia in a patient with anisometropia; endocrine disturbance acting through fatigue of accommodation; and tobacco affecting accommodative fatigue. In addition to measures for improving the health of the patient, orthoptic treatment seems occasionally to benefit, even in the absence of definite indications, perhaps by increasing resistance to ocular fatigue and by improving coördination and amplitude of fusion. (9 illustrations, references.)

W. H. Crisp.

Burt, Cyril. The relation between eye color and defective color vision. Eugenics Rev., 1946, v. 37, Jan., pp. 149-156.

The author presents the results of his studies on the relationship between the pigmentation of the iris and defects of color vision. His efforts are intended to interest others to submit further data such as pedigrees, family records and individual patients for psychologic examination. In a previous survey of school children decidedly fewer color blind were found among those who had light colored eyes. Correlation of hair color with defective color vision was negligible.

The surveys made of military men during the past showed that there were more than half again as many color defective subjects among the dark-eyed than in the light-eyed individuals. The

tests were made with Ishihara charts.

The author feels that there must be some genetic link between pigmentation of the iris and defective color vision and that the final explanation depends on further knowledge of the underlying physico-chemical processes.

Francis M. Crage.

Cristini, Giuseppe. The value of the color triangle of König and Dieterici for clinical examinations in ophthalmology. *Riv. di Oftalm.*, 1946, v. 1, Jan., pp. 15-27.

In 1936, the International Commission for Illumination accepted the König-Dieterici modification of the Young-Helmholtz color theory as a basis for measuring and standardizing colors. Haschek's microphotometer fulfills all the requirements or an exact identification of any color by a figure corresponding to that particular color and to no other. Therefore, it will be of great value for scientific as well for clinical questions concerning the color perception of normal eyes as well as of those with defective color perception. For details the original article should be studied. (References.)

K. W. Ascher.

Dekking, H. M. On adaptation. *Ophthalmologica*, 1945, v. 110, Sept.-Oct., pp. 138-169.

Investigations on the course of dark adaptation after short flashes, made by means of a quick-recording adaptometer, show that the process of adaptation is more complicated than is generally assumed. The apparatus which was designed by the author is described in detail. The study leads to a theory of retinal processes of which the well-known and much-studied adaptation curve after complete bleaching-out is a special case. A new principle is intro-

duced. It is assumed that light sensation is proportional not to the concentration of visual purple but to the difference between concentrations of visual purple inside and outside of the retinal cell. This one principle makes possible an explanation of adaptation phenomena under any experimental condition, of the origin of the after image and the peculiarities of its duration and intensity after various exposures, and of the phenomenon of simultaneous contrast. (8 diagrams, 19 curves.)

F. Nelson.

Delgado, J. M. R. Extramacular form vision. *Ophthalmologica*, 1945, v. 110, Sept.-Oct., pp. 170-190.

Extramacular perception of form was investigated by presenting eight different figures to the subject on a Ferec-Rand perimeter. The figures are a circle, a square, a triangle, a wavy line, two dots, and a narrow rectangle each of which had a surface area of 4 mm.² Two other narrow rectangles had half and twice this area. The figures were presented in each of eight meridians and the subject was required to draw what he saw at intervals of five degrees.

Pattern must be regarded as important in any test in peripheral vision. The concentrated patterns which are comparatively circular, can be more easily distinguished in a wider field of vision than straight lines of the same size which are described as dispersed pattern. A concentrated pattern of 2 to 4 mm.² surfaces can be seen in a field of vision twice as large as a dispersed pattern.

This is explained by assuming that a concentrated pattern stimulates a larger number of the visual receptors that are functionally attached to one ganglion cell and that the sum of their impulses exceeds the threshold of this

ganglion cell. The dispersed pattern stimulates a greater number of receptors but these are bound to different ganglion cells and the sum of their impulses is below the threshold of the ganglion cell.

The Bunsen-Roscoe law on the necessary constancy needed by a given mass of energy to reach the threshold of the retina must be revised. The law remains valid for stimulation of the peripheral visual cells only for cells that are associated with one derivative cell. A portion of this energy is lost if the stimulus is brought to cells in connection with several ganglia. (7 figures and charts.)

F. Nelson.

Elder, J. H. Note on Dunlap's remedy for defective color vision. *Psychol. Bull.*, 1946, v. 43, Jan., pp. 77-79.

Nine hundred cadets at Louisiana State University were examined for color vision as a check on Dunlap's original report that 80 percent of his patients were able to pass test charts after taking vitamin A. Of the 65 men with defective color vision, 41 completed the course of treatment. The results were entirely negative. The technique used in the Elder experiment was practically the same as that of Dunlap.

Francis M. Crage.

Fortin, E. P. The achromatism of the eye. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Nov., p. 598.

In this brief article the author presents his own theory to explain the achromatism of the eye.

Plinio Montalván.

Graham, R. Reduction of reflections. *Arch. of Ophth.*, 1946, v. 36, Sept., pp. 315-320.

Since 1938 Strong, whose work was done at the California Institute of

Technology, and Cartwright and Turner, whose major work was done at the Massachusetts Institute of Technology, have developed a process which combines the maximum efficiency with the greatest durability. This process, as utilized in optical lenses for the armed forces of this nation, consists in depositing a thin film of magnesium fluoride on optical surfaces in high vacuum and under considerable heat.

When light, traveling in air, impinges on the polished surface of crown glass of index 1.52, the loss is 4.2 percent at each surface. Coating with magnesium fluoride reduces this loss to 1.3 percent. In an optical system made up of many surfaces, the cumulative saving in light is considerable. In bright daylight, a reduction of ghost images due to interface reflections, and an increase in contrast and detail results. In dim illumination this conservation of light often makes an optical system useful when, before coating, it would not have transmitted enough light. The tremendous value of this process in extending, both at dusk and dawn, the period of usefulness of photographic operations, observation devices, and gunfire control systems can be appreciated.

In ophthalmic optics one finds different and more exacting conditions. At this stage of development of the science, one cannot expect a repetition of the almost complete acceptance found in instrumental optics. For ophthalmic use the coat must be rugged indeed, for it is exposed to repeated cleaning and much abrasion. The reduction of reflections is only about 50 percent. Scratches on a coated surface are more visible. Furthermore, the gain in transmission, which is so important in a multisurface system, is practically meaningless in a two surface lens, in

which loss of light is seldom a problem.

Reflections from glasses into the eyes of the wearer occur with everyone. But it cannot be said to constitute a serious problem until the intensity of the reflections exceeds the tolerance of the patient. The tolerance of reflections will be lowest in neurasthenic and hypercritical patients.

Reflections from glasses can do more than annoy the wearer. They can, and often do, conceal the eyes of the wearer from any one looking at him. For all who wear glasses when appearing before groups of people this is a serious impediment. R. W. Danielson.

Goldman, H., and Aschmann, A. Studies on accommodation, (correction of paresis of accommodation and the physical and physiologic range of accommodation.) *Ophthalmologica*, 1946, v. 3, Feb.-March, pp. 182-186.

This study is the first attempt to measure the strength of the ciliary muscle, that is, the physiologic range of accommodation rather than the physical range. It was found that the strength of the ciliary muscle is always more extensive than the physical accommodation but it is smaller than would have been expected on the basis of the Donders-Hess modification of Helmholtz's theory. Tscherning's theory is incorrect because the physiologic range of accommodation, expressed in diopters, is always larger than the physical range of accommodation.

The authors also discuss the correction of monocular paresis of accommodation. (1 figure.) Alice R. Deutsch.

Hardy, L. H., Rand, G., and Rittler M. C. Color vision and recent developments in color vision testing. *Arch. of Ophth.*, 1946, v. 35, June, pp. 603-614.

This essay contains a condensed, simplified expression of the working hypotheses used by color vision investigators today, a note on the ICI Coordinate System and Standard Observer, comments on some typical color tests in current use, and an empiric classification of the types of color vision. It contains so much valuable material in condensed outline form that it cannot be suitably abstracted.

John C. Long.

Holmes, W. J. Night Vision. *Arch. of Ophth.*, 1946, v. 36, Sept., pp. 302-314.

In a previous article comparative data on the results of examination of night vision of 217 Caucasian and 217 Japanese students were reported. The purpose of the present paper is to furnish statistical data on the correlation that was found between the instruments used, to describe briefly some of the other instruments and technics employed in night vision testing, and to proffer a plan, based on physiologic and optical principles, for universal adoption, for the complete examination of the function of night vision.

Comparisons were made of six devices used for investigating night vision. The correlation that existed among these devices was not sufficient to warrant their use interchangeably. A partial list of additional devices used for testing dark adaptation and night vision is appended, together with objections raised against them. A thorough, systematic method of examination based on physiologic principles for the study of the function of night vision is described and its uniform acceptance advocated. R. W. Danielson.

Jasmen González, Alfonso. Frequency of refractive errors. *Arch.*

Chilenos de Oft., 1945, v. 2, Nov.-Dec., pp. 19-25.

A brief review of the statistical literature of the subject. (References.)

W. H. Crisp.

Knüsel, O. New facts about contact glasses. *Ophthalmologica*, 1946, v. 111, April-May, pp. 291-294.

This paper contains a review of the history of contact lenses and the changes in their specifications. The author's own new method consists of an exact measurement of the superficial curves of the eyeball, as well as the distance from the limbus of the contact glass to the corneal center. The existence of only several fixed types in the variations of the scleral surface simplifies this procedure. Because of the lack of adequate material, the author had to use plexiglass.

Alice R. Deutsch.

Pascal, J. I. Lens efficiency—a clinical concept. *Brit. Jour. Opth.*, 1946, v. 30, May, pp. 291-298.

The spectacle lens varies in its effectivity with its distance from the eye. It is less well known that a fully corrected emmetropic, hyperopic, and myopic eye use different amounts of accommodation for the same distance, and the magnitude of this difference in the optical instrument that consists of eye and spectacle lens may be referred to as lens efficiency. Because a corrected myopic eye uses less of its accommodation for a given distance than a hyperopic eye does the concave spectacle lens may be considered more efficient.

In the anisometropic presbyopic eye it is necessary to give a stronger addition for near work to the more hyperopic or less myopic eye. (1 table.)

Morris Kaplan.

Sloan, L. L. Selection of color vision tests for the army air forces. *Arch. of Opth.*, 1946, v. 36, Sept., pp. 263-283.

In the previous sections it has been shown that in the selection and classification of air force personnel two types of color vision tests are needed. The basic screening test should provide a simple, rapid, and reliable means of distinguishing normal from deficient color vision. The second test, to be given only to subjects who fail the basic test, should give a reliable and valid estimate of the degree of defect.

A detailed recitation of the advantages of many types of color vision tests is given. Of the various quantitative tests investigated, the Color Threshold Test appears to be the most satisfactory for the classification of flying personnel.

A report by Wallace and associates is quoted to the effect that people with normal and deficient color vision can detect camouflaged areas with about the same ability. R. W. Danielson.

Weekers, R. and Roussel, F. Use of campimetry in dimmed light for measurement of dark adaptation of the retina. *Ophthalmologica*, 1945, v. 110, Nov.-Dec., pp. 242-258.

The state of retinal adaptation can alter the position of the isopters considerably if these are measured in reduced illumination (less than 30 Lux). A progressive increase of the visual field, taken in reduced illumination, is an excellent measure for adaptation of the rods when plotted as a function of the times of exposure to darkness.

The contraction of the field in reduced illumination constitutes a reliable and sensitive quantitative test for nightblindness.

Certain dietary deficiencies, chiefly

of proteins and lipoids, cause a concentric contraction of the field in reduced illumination. The measurement of the field of vision in reduced light is the method of choice for the discovery of scotomata of slight density; but it is important to emphasize the fact that the position of the isopters varies with the state of retinal adaptation and that nightblindness can cause a definite contraction. (2 figures, 4 adaptation curves, 3 tables, references.)
F. Nelson.

Wölfflin, E. A new apparatus for examination of stereoscopic vision. (Preliminary report.) *Ophthalmologica*, 1945, v. 110, Sept.-Oct., pp. 212-218.

The author describes a new piece of apparatus with which stereoscopic vision can be more accurately measured, since both accommodation and convergence can be completely eliminated. (1 photograph, 1 curve.)

F. Nelson..

Woods, A. C. Treatment of myopia by visual training. *Trans. Amer. Acad. Ophth. and Otolaryng.*, Nov.-Dec., 1945, pp. 37-65.

From 130 applicants 103 myopic individuals were selected and were given visual training by a group of optometrists and psychologists. Each patient was previously examined by the author and his associates. This examination included four separate visual acuity tests at 20 feet, retinoscopy, and subjective testing with a cycloplegic of 5-percent homatropine or 1-percent atropine solution. External and ophthalmoscopic examinations were made to exclude trainees with abnormal ocular tissues. Approximately three months after the visual training the patients were reexamined. Slight consist-

ent improvement on all four charts was noted in 29 percent; no consistent improvement, but an over-all improvement in both eyes in 30 percent; no change in visual acuity in 31 percent; and decreased visual acuity in 9 percent.

Results were computed in terms of the percentage of visual acuity. Although this is the only practical method, it easily creates a false impression by exaggerating slight differences of visual acuity. The improvement noted was attributed to education in the correct interpretation of blurred visual images and to beneficial psychological reactions of some patients toward their visual handicap. This study clearly shows that visual training as used on these patients was of no practical value in the treatment of myopia.

Chas. A. Bahn.

Woods, Ralph H. Some reasons for ocular discomfort. *Illinois Med. J.*, 1946, v. 89, June, pp. 276-279.

The outstanding causes of ocular discomfort in individuals wearing glasses are failure of the oculist to analyze the prescription, to balance accommodation and convergence, and to consider cyclophoria and anisometropia. Most of the discomfort occurs in desk workers, students, teachers, doctors, and lawyers. Cyclophoria is a real clinical entity and not at all uncommon. It can be measured by means of two vertical maddox rods, one red and one white. Anisometropia causes discomfort by introducing a difference in size of the retinal images and also by producing undesirable prismatic displacements. The spherical difference between two lenses should never be over one and a half diopters. Lenses should be analysed before a prescription is given to the patient. John B. Hitz.

4

OCULAR MOVEMENTS

Coppez, M. H. Miners' nystagmus. *Bull. Acad. roy. de med. de Belgique*, 1943, v. 8, April, pp. 212-225.

The author reviews the history of miners' nystagmus. He considers that three factors may be of etiologic importance: the darkness of the mine, toxic gases, and the elevation of the gaze. He believes that miners' nystagmus might be an exaggeration of the normal micronystagmus of fixation.

Jose Saenz Canales.

Danis, Pierre. Congenital oculo-facial paralysis. *Ophthalmologica*, 1945, v. 110, Sept.-Oct., pp. 113-137.

Congenital paralyses of the cranial nerves are rare. The author observed one infant with bilateral facial paralysis associated with bilateral paralysis of the lateral rotators of the eyes. In two others facial paralysis was unilateral. He reviews the literature extensively and presents the pertinent data in a graphic chart. On the basis of this material he presents a new classification of the congenital disturbances of ocular movement in the horizontal direction and discusses the frequency of congenital paralysis of the facial nerve within these groups. (12 photographs, 1 chart.)

F. Nelson.

Dejean, C. Measurements in strabismus operations. *Arch. d'Opht.*, 1946, v. 6, no. 1, pp. 1-15.

Dejean has made a study of the technic of strabismus operations in an attempt to bring greater precision to the various procedures. He criticizes the classical operations because of the variability of the results obtained. He considers the operation of tendon ad-

vancement unsound since anatomic study has shown that reattachment generally takes place at the old insertion; he finds resection a more logical procedure. He considers complete tenotomy a hazardous operation and favors tendon lengthening as safer and more precise. He describes in detail his own technic of muscle surgery and stresses the importance in the resection operation of leaving a 2-mm. stump which gives complete security in the reattachment of the cut end of the tendon. A single suture is tied transversely across the tendon fibres and, in order to give greater security, the conjunctiva is included. As a substitute for tenotomy Dejean employs a tendon lengthening procedure of the same type as is used in orthopedic surgery for lengthening the tendon of Achilles. It consists in the partial sectioning of the tendon in two places on opposite sides. By varying the length of the sections a graded effect can be obtained.

The author concludes with a study of measurements and offers a table by which the effect of operations on the horizontal muscles can be estimated.

Phillips Thygeson.

Faulkner, S. H. Ocular paralysis following spinal anaesthesia. *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, pp. 234-236.

The author reviewed the literature on the paralysis of the ocular muscles following spinal anesthesia and found that the sixth nerve was involved most frequently, the fourth and third less frequently. There was associated miosis and mydriasis.

The time of onset was usually three days to three weeks after the anesthetic in all patients. The anesthetic was followed by severe headache persisting

until the time of paralysis when diplopia became an added symptom.

Beulah Cushman.

Grignolo, Antonio. Optic neuritis and oculomotor paralyses in zoster ophthalmicus. *Boll. d'Ocul.*, 1945, v. 24, Jan.-March, pp. 60-82.

A woman, 48 years of age, had the typical lesions of herpes zoster in the territory of the first and second branch of the left trigeminus. Intense pain and high temperature accompanied the skin manifestation whereas the central vision and visual field were within normal limits in both eyes. A few days after the onset of the affection ptosis of right right upper lid and paresis of the superior rectus muscle manifested themselves together with keratitis; the right disc became pale and the vision nil. The diagnosis of acute retrobulbar optic neuritis with paralysis of eye muscles from herpes zoster ophthalmicus was made. Reëxamination a year later revealed that the paralyses had disappeared, the right disc was white and the vision nil. The etiology and pathogenesis of the optic neuritis and ocular paralysis in herpes zoster ophthalmicus is discussed at length. (Bibliography.)

Melchior Lombardo.

Just Tiscornia, B., and Lami, I. Ocular complications in tumors of the nasopharynx. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Nov., p. 557.

The authors stress the high incidence of ocular complications in tumors of the nasopharynx. They present an anatomical review in order to explain the mechanism of involvement of the eye in the evolution of these tumors. Eight cases of malignancy of the nasopharynx are reported, in five of which there was ocular involvement early in the course of the disease. Involvement of the ex-

traocular muscles is the most frequent type of complication, although ocular symptoms that result from lesions of other cranial nerves, as well as exophthalmos, may occur. Epithelioma and sarcoma are, in order of frequency, the most common tumors. Surgery and deep radium therapy is the treatment of choice when the diagnosis is made early. (Bibliography.)

Plinio Montalván.

Latorre, S., and Rios Sasiain, M. Synkinesis between the orbicularis and the internal rectus in a case of bilateral paralysis of the third nerves. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, April, pp. 351-356.

A 48-year-old woman, with lues, had a bilateral paralysis of the oculomotor nerves, with integrity of the sixth cranial nerves. With forced contraction of the orbicularis the eyes were adducted. The pupil remained dilated and the contraction of the internus could be elicited in each eye independently. The differentiation of this phenomenon, and Bell's, Piltz-Westphal's and Axenfeld-Schurenberg's disease are discussed. The author believes that this is the first case of this type of synkinesis reported.

Ray K. Daily.

Van Lint, M. A. The role of otitis in the etiology of convergent strabismus. *Bull. Soc. Belge d'Ophth.*, 1945, no. 81, April 29, pp. 31-37.

The author reviews various theories of convergent strabismus. The role of age in infection is also discussed and it is significant that spread to the neighboring areas is much easier in the younger age group. Middle ear disease in the very young can spread to the neighboring regions and may include the sixth cranial nerve. A paralysis of divergence or exaggerated convergence

may follow. Statistics are presented which reveal that 61 percent of convergent strabismus occurs in children from one to five years of age, and falls to 8 percent from five to 10 years of age and to 1 percent after 10 years of age. On the basis of these statistics, the author refuses to accept the exclusive role of hypermetropia and excessive use of convergence as the sole etiologic agent, because under these circumstances one would expect the greatest incidence of convergent strabismus to occur between the seventh and eighth years of age, after the child has learned to read. M. R. Cholst.

Mann, Ida. Orthoptics. *The Practitioner*, 1946, v. 157, August, pp. 150-151.

Mann defines orthoptics as a form of treatment designed to produce or improve binocular stereoscopic vision. She feels that the potentialities of orthoptic exercises must be thoroughly understood by the attending ophthalmologist in order to avoid disappointment after undue optimism as to their possibilities. In conclusion she states that it is obvious that orthoptic treatment combined with refraction and surgery should be considered in any case of imperfect binocular vision.

John B. Hitz.

Mayou, Sheila. Treatment of convergence deficiency, 1933-1944. *Brit. Jour. Ophth.*, 1946, v. 30, June, pp. 354-370.

The method of diagnosis and treatment of convergence deficiency in the orthoptic department of the Central London Ophthalmic Hospital is presented in detail. During a three year period 1,266 patients were seen; 599 had squint, 89 had phorias, and 578 con-

vergence deficiency. After treatment 72 percent of the patients with convergence insufficiency were cured. Sixteen percent did not complete their treatment. The treatment consists of a system of voluntary convergence lessons which the patient pursues at home by pencil to nose exercises and a stimulation of physiologic diplopia. These exercises plus exercises on the synoptophore are accomplished in six half-hour lessons and apparently are all that is necessary for accomplishment of the cure. Morris Kaplan.

Simonelli, Mario. A case of Parinaud's Syndrome. *Riv. di Oftalm.*, 1946, v. 1, Feb., pp. 110-123.

A woman, 36 years of age, became ill one year before admission to the Firenze Eye Clinic where a paresis of convergence, a paralysis of the depressors, a paresis of the left trochlear nerve, and anisocoria accompanied by Argyll-Robertson pupil, were found. The acute illness is assumed to have been an attack of epidemic encephalitis that involved the mesencephalon. Problems of localization, particularly of the Argyll-Robertson sign, are discussed. (References.) K. W. Ascher.

Smith, James W. Medical significance of ocular torticollis. *Bull. Hosp. for Joint Diseases*, 1945, v. 2, Oct., pp. 99-109.

Smith indicates the varying etiology and points out how valuable routine photography may be. Photographs are made of the patient, stripped to the waist, as he stands in front of a black screen on which thick vertical and horizontal white lines are ruled to form $2\frac{3}{4}$ -inch squares. The screen is seven feet high and three feet wide. (References.) F. H. Haessler.

5

CONJUNCTIVA

Badir, Camil. **Schistosomiasis of the conjunctiva.** Brit. Jour. Ophth., 1946, v. 30, April, pp. 215-221.

Schistosomiasis of the conjunctiva is very rare in relation to the large number of patients affected with bilharzia in Egypt.

The pathologic report on a tumor removed from the conjunctiva of an Egyptian boy is presented. The mass resulted from schistosomiasis. Numerous ova were easily seen and for the first time the adult male and female *Bilharzia* worms were seen in situ in the conjunctival tissue. The life cycle of the worm is described and several possibilities for the route between the right heart and the conjunctiva are suggested. None of these completely satisfied the author. (3 illustrations.)

Morris Kaplan.

Bouquin, J. B. **Parinaud's conjunctivitis and the syndrome of Löffler.** Ophthalmologica, 1946, v. 3, Feb.-March, pp. 73-95.

The author discusses in detail the differential diagnosis and the possible etiology of Parinaud's conjunctivitis and also suggests a possible allergic origin. He observed a boy, eight years of age, who had various intestinal parasites, Parinaud's conjunctivitis and Löffler's syndrome. The latter consists of mild transient pulmonary infiltration, lymphocytosis, slight increase in sedimentation rate, and a characteristic rise in an eosinophilia which typically follows the height of the pulmonary infiltration. It is an allergic reaction. (References.)

Alice R. Deutsch.

Colombo, Gian Luigi. **Conjunctival reaction simulating a tumor.** Boll.

d'Ocul., 1945, v. 24, Jan.-March, pp. 52-57.

A girl, 9 years of age, had a reddish fleshy formation that protruded from the lid aperture at the inner angle of her left eye. It originated from the upper fornix and measured 3 cm. in length, 1½ cm. in width and 5 mm. in thickness. It was removed at its base. Microscopic examination revealed a mass that consisted of blood vessels of different sizes and of enlarged lymphatic vessels and covered by epithelium. Embedded in the mass was a piece of twig from a broom which had been introduced in the conjunctival sac for fun.

Melchior Lombardo.

Goldfarb, A. A. and Seltzer, I. **Primary tuberculosis of the conjunctiva.** Am. J. Dis. Child., 1946, v. 72, Aug., pp. 211-215.

Primary tuberculosis of the conjunctiva is rare, unilateral, usually occurs before the age of thirty years, and is characterized by involvement of the satellite and preauricular nodes. A boy, ten years of age, developed swelling of his right preauricular node and also of a node under the jaw. Two days later swelling of the right eye was noted and a well defined dirty ulcer was present in the conjunctiva. Biopsy revealed typical tubercles with acid-fast bacilli, and scrapings cultured on Petragrani medium produced a growth of acid-fast bacilli. (2 figures.)

I. E. Gaynon.

Knüsel, O. **Double staining with scarlet red and methylene blue. The clinical evaluation of a twin dye of the conjunctiva in vivo.** Ophthalmologica, 1946, v. 111, April-May, pp. 295-297.

The normal conjunctiva does not stain with either scarlet red or methylene blue, except for isolated epithelial

cells and droplets in the secretion or the tears. Whenever such staining appeared in the grossly unchanged conjunctiva some infiltration was found at biopsy. The stained corneal cells appear brown in reflected light and dark red in transillumination. The conjunctival cells are brown or wine red.

This test might be a diagnostic aid in patients with apparently mild conjunctival irritations and exaggerated discomfort. Alice R. Deutsch.

Marks, E. O. Treatment of trachoma. *Brit. Jour. Ophth.*, 1946, v. 30, April, pp. 213-215.

The author presents a plea for milder local therapy of trachoma. He agrees that sulfonamides affect the secondary infection but have little effect on the disease itself. In his less virulent cases he simply uses boric acid lavages and instillations of zinc sulphate solution. His results have been very satisfactory.

Morris Kaplan.

Mosquera, Sanchez. Operation for recurrent pterygium. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Oct., pp. 856-858.

The author excises the pterygium, and covers the defect with 3 by 8-mm. sliding flaps of healthy conjunctiva taken above and below the pterygium. Recurrences were especially frequent when the defect was carefully covered up to the limbus. When the raw area close to the limbus was left uncovered the fibrous cicatricial tissue, firmly adherent to the sclera, acted as a barrier to the recurrence of the pterygium.

Ray K. Daily.

Rados, A. Reticulum cell sarcoma of the conjunctiva. *Arch. of Ophth.*, 1946, v. 35, April, pp. 400-414.

Tumors of the hematopoietic system

are discussed in considerable detail. Reticulum cell sarcoma is regarded as a form of lymphosarcoma which may arise in lymph nodes but may also originate in various organs, including bone. Metastasis is by the lymphatics. The ophthalmic literature contains two cases diagnosed as reticulum cell sarcoma. In both of these cases the process was local, without the systemic involvement characteristic of reticulum cell sarcoma. The author reports the case of a 29-year-old man with marked papillary hypertrophies of the conjunctiva of the left eye and preauricular adenopathy. A biopsy of the conjunctival mass was characteristic of reticulum cell sarcoma. Roentgen therapy was instituted. About five months later the patient experienced unbearable pain in the back, had a septic temperature and died about seven months after the tumor appeared on the conjunctiva, with symptoms suggestive of multiple metastases in the spine. (References, 2 illustrations.)

John C. Long.

Robertson, E. C., and Morgan, A. L., Effect of added vitamin A on conjunctivitis and level of vitamin A in blood. *J. Nutrition*, 1946, v. 31, April 10, pp. 471-484.

The experiment reported in this paper was performed in an attempt to verify a report by H. D. Kruse (1941) that 99 percent of a group of adults in low income brackets had diminished transparency of the bulbar conjunctiva, due to avitaminosis A.

In this experiment, half of a group of 40 student nurses (on normal diets) were given 50,000 units of supplemental vitamin A daily; the other half were observed as controls.

The authors used an arbitrary classification for conjunctival transparency,

based on the clearness with which episcleral vessels could be seen in slitlamp examinations. They were unable to note any significant changes in the degree of conjunctival "transparency" after two years of added vitamin A, nor were there any differences between the experimental and the control groups. Blood levels of vitamin A were not significantly different in these two groups after two years of therapy (recorded 11 to 13 hours after ingestion of vitamin A.) It was concluded that the conjunctival thickening, which was reported to be present, to some degree, in every subject, was not due to avitaminosis A. Benjamin Milder.

Sayrum, Adnan. An ocular complication of exudative erythema multiforme. *Göz Klinigi*, 1946, v. 4, no. 1, pp. 1-4.

The author describes an erythematous patch that occurred on the conjunctiva in a man 25 years of age, in the course of erythema multiform that involved the upper portion of his trunk. F. H. Haessler.

Shimkin, N. I. Conjunctival hemorrhage due to infection of Newcastle virus of fowls in man. *Brit. Jour. Ophth.*, 1946, v. 30, May, pp. 260-264.

A case of hemorrhagic conjunctivitis due to the Newcastle virus in a human is reported. This virus is the cause of a fatal hemorrhagic disease of fowls and has very rarely occurred in man. When it does occur, infection is by direct contact and pursues a very benign course that is complete in 7-14 days. Morris Kaplan.

6

CORNEA AND SCLERA

Almeida, Antonio. Kerataconus and persistent thymus. *Bol. da Soc. de Med.*

e Cirurg. de Campinas, 1946, v. May, pp. 113-117.

In patients from eight to 39 years of age the author was able to demonstrate hypertrophy of the thymus, immediately after anterior pneumomediastinum had been produced by the technique of Cordarely, by means of radiographic studies according to the method of Alamilla.

He believes that irradiation of the thymus may not only reduce the size of the gland but also retard the development of the corneal condition with remarkable increase of the visual acuity. Jose Saenz Canales.

Amsler, Marc. Classic keratoconus and incomplete keratoconus. Arguments concerning a common etiology. *Ophthalmologica*, 1946, v. 3, Feb.-March, pp. 96-101.

Four facts support the author's theory of a common origin of classic and incomplete keratoconus:

- (1) the condition of the second eye.
- (2) the morphologic evolution of the corneal deformity, from a mild irregular astigmatism through all the stages of progressive thinning and conus formation of the severe classical form.
- (3) the occurrence of classic keratoconus in some members of a family and an incomplete mild keratoconus in others and (4) the development of a classic keratoconus from an incomplete one in the same person. (7 figures.)

Alice R. Deutsch.

Arruga, H. A new technic for corneal tattooing. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, June, pp. 423-426.

Arruga uses ordinary China ink. He injects it with a tuberculin syringe and a fine needle into the layers of the corneal parenchyma. He outlines the pupil with a superficial trephine, which

cuts $\frac{1}{2}$ to 1 mm. deep. The groove thus formed limits the penetration of the ink. The advantage claimed for the procedure is the ease of execution, and the stability of the postoperative result.

Ray K. Daily.

Babel, J., and Campos, R. The regeneration of nerves in corneal grafts. *Ophthalmologica*, 1946, v. 3, Feb.-March, pp. 140-145.

Four corneal grafts removed in a second or third keratoplasty were studied by means of a modified Bielschowsky stain. The nerves in a graft develop in relation to the vessels for several weeks. Their regeneration is slow but eventually they become more numerous than in the normal cornea. The distribution differs from a normal cornea and the subepithelial net is always absent. This might account for the hyposensitivity of the corneal transplant. An early regeneration of the nerves may be important for the metabolism of the graft and its eventual transparency. (7 figures, references.)

Alice R. Deutsch.

Bellows, J. G. Influence of local antiseptics on regeneration of corneal epithelium of rabbits. *Arch. Ophth.*, 1946, v. 35, July, pp. 70-81.

During World War II the incidence of ocular injuries was unusually high. Recent reports have pointed out that a wide variety of agents affect adversely the healing of the epithelial defects of the cornea. No agent has yet been discovered which increases the rate of healing.

Bellows reviews the literature regarding the now well-known retardation of healing due to the use of local anesthetics. The effect of antibacterial agents commonly used in ocular therapeutics on the regeneration of the

corneal epithelium, has not been reported.

Young adult rabbits, weighing approximately 2 Kg., were employed in this investigation. The cornea was anesthetized with a 4-percent solution of cocaine hydrochloride, chosen not only for its anesthetic qualities but for its drying effect, which facilitated the removal of the epithelium; this was accomplished by rubbing the cornea with dry gauze; to make certain that the entire cornea was denuded of its epithelium, the eyes were stained with fluorescein. The course of regeneration was observed by daily examination, facilitated by fluorescein staining.

The drugs to be investigated were instilled in the left eyes of rabbits three times daily, and a similar amount of isotonic solution of sodium chloride in the right, or control eye. Five rabbits was the minimum number used for each drug. Aqueous solutions of the following substances were investigated: mild silver protein (10 percent), zinc sulfate (0.5 percent), merbromin (2 percent), phemerol chloride (1:2,500 concentration in 2-percent boric acid solution), mercuric oxycyanide (1:5,000), metaphen (1:2,500), merthiolate (1:2,500), acriflavine (1:1,000), zephiran chloride (1:3,000), penicillin (1 c.c. containing 2,500 Oxford units) and sodium sulfathiazole (2 percent).

The untreated eyes healed more rapidly than the treated eyes in nearly all cases. Phemerol chloride solution delayed the healing only slightly and produced no permanent alterations in the cornea. Sodium sulfathiazole, in 2 percent aqueous solution, and penicillin, in a concentration in which 1 c.c. contained 2,500 Oxford units, neither delayed the regeneration of the epithelial covering nor produced corneal opacities.

Repeated instillations of the common local antiseptics are not recommended in the treatment of corneal injuries. When the possibility of infection is great, the aqueous solution of sodium sulfathiazole or penicillin may be used. (References, 10 illustrations.)

R. W. Danielson.

Bischler, V. The nodular corneal dystrophy of Salzmann. *Ophthalmologica*, 1946, v. 3, Feb.-March, pp. 111-119.

Salzman's nodular dystrophy represents a clinical, pathologic, and etiologic entity and may be well distinguished from Groenouw's nodular dystrophy, a variation of which it was originally thought to be.

Prominent, round, well outlined nodules of considerable size and bluish white color, located in the anterior third of the corneal parenchyma and a shiny epithelium characterize the clinical appearance. The pathologic picture is characterized by a thinned epithelium with flattened cells and no basal layers, destruction of Bowman's membrane, and a stroma that is poor in fixed cells and has pale, swollen fibers, hyaline masses, and no vascularization.

The author describes two observations of his own. After conservative treatment had failed corneal transplants gave excellent results. (3 figures, references.)

Alice R. Deutsch.

Bürki, E. Hereditary epithelial dystrophy (type Meesmann). Another pedigree. *Ophthalmologica*, 1946, v. 3, Feb.-March, pp. 134-139.

The existence of hereditary corneal dystrophies which fit neither into Buckler's nor Franceschetti's and Babel's classification makes a rearrangement of these groups necessary. This was done by the author. He also de-

scribes a familial corneal degeneration restricted to the epithelium, which affected Bowman's membrane only slightly. Meesmann published a similar case. (3 figures.)

Alice R. Deutsch.

Campbell, Dorothy. A note on the treatment of hypopyon ulcer. *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, pp. 256-259.

The author reports the results obtained in treating hypopyon ulcer with sulfonamides. She compares the results with a group in which the sulfonamides were not used. The sulfonamides were administered in full doses for at least 48 hours and the average length of stay in the hospital was 28 days.

The early use of a sulfa drug after a foreign body injury of the cornea was a satisfactory preventive. Sulfa drugs administered locally and by mouth combined with mild cautery and the injection of foreign protein produced the most satisfactory results.

Beulah Cushman.

Castan, J. H. True microcornea with myopia. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Aug., pp. 693-696.

A patient is described who had myopia of eleven diopters with myopic fundus changes, and whose right eye had a microcornea and a large coloboma of the choroid and optic nerve. The diameter of the right cornea was 8 mm., and that of the left 10. The radius of the corneal curvature was 6.9 mm. for the right, and 7.4 for the left. The phenomenon is rare. The differential diagnosis between microcornea and cornea plana is explained in detail. The hereditary transmission of the affection appears to be recessive, and not sex-linked.

Ray K. Daily.

Cogan, D. G., and Kinsey, V. E. Action spectrum of keratitis produced by ultraviolet radiation. *Arch. of Ophth.*, 1946, v. 35, June, pp. 670-677.

The action spectrum for keratitis produced by radiation was determined on rabbit eyes, with the radiant energy produced by a large quartz monochromator. Changes in the cornea were studied by means of the biomicroscope and slitlamp. The cornea was found to have a peak sensitivity to ultraviolet radiations at wavelengths of about 288 millimicrons, with a sharp decline in sensitivity to either side of the peak. The amount of energy necessary to elicit an ocular reaction at 288 millimicrons was approximately 0.15×10^6 ergs per square centimeter. Although the absorption peak of the corneal epithelium corresponded to that of nuclear protein (265 millimicrons), the peak of the action spectrum corresponded more nearly to the absorption peak of albumin and globulin (280 millimicrons). From this it may be inferred that the photochemical reaction in the cornea is due to a selective absorption by a substance having a peak in the wave-lengths longer than that of nucleoprotein or by certain constituents only of the nucleoprotein molecule. The transmission characteristics of various types of common glass were measured for that portion of the spectrum which is responsible for keratitis. (References, 5 illustrations.) John C. Long.

Corrado, M. Corneal complications in malariatherapy. *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 73, Jan., pp. 22-32.

Corrado reports two cases of herpetic keratitis (one of simple herpetic keratitis and the other of dendritic keratitis) occurring shortly after the final attack of fever induced by inoculation with malaria for treatment of

neurosyphilis. He deems the malarial parasite and the fever to be merely agents that precipitate but do not cause the keratitis. The presence of the herpes virus is of course necessary, but general and local factors are likewise important. A general predisposing cause is weakness of the organism as a whole, either existing before the induced malaria or resulting from the action of the malarial toxin. A noteworthy local cause is, in his opinion, a lability of the corneal nerves, which may be ascribed to the antecedent luetic infection or to a vitamin B₁ deficiency.

He suggests that ocular complications in malariatherapy can possibly be prevented by the concomitant administration of vitamin B₁ because of its regenerative action on the nerve fibers, and of vitamin A because of its protective and regulatory action on epithelial regeneration.

Harry K. Messenger.

Diaz-Caneja, E. Blue scleras and imperfect osteogenesis for Lobstein-Vrolick's disease. *Arch. de la Soc. Of. Hisp.-Amer.*, 1945, v. 5, Aug., pp. 630-655.

An exhaustive review of the literature, and a report of two genealogical trees with tabulated data of the symptoms in 11 cases are presented. The inheritance of the disease is dominant, without sexual predilection, and is attributed to a hypoplasia or a dysplasia of the mesenchyme, with consequent disturbance in the development of the mesoderm and in the calcium metabolism. Blue scleras were found in 94.4 percent of the reported cases, fractures in 55.9 percent, and otosclerosis in 23.7 percent. Blue scleras are thus the most frequent symptom of the disease. Opinions differ as to the cause of

the blue color. Most investigators attribute it to a thinning and consequent increase in the transparency of the sclera. Vogt disagrees with this view, and concluded from biomicroscopic studies that the sclera is not thinned, and that the blue color is due to a hyalinization of the fibrous tissue. In the eleven cases seen by the author there was complete absence of the normal biomicroscopic structure of the vitreous in seven patients. It had a gelatinous appearance without a fibrillary component. The author believes that this condition is not a disorganization secondary to an inflammatory process, but a true primary aplasia of the vitreous which is due to a dysfunction of the mesenchyme. The arcus lipoides, found in three of the eleven patients is also attributed to the mesenchymal dysfunction. (3 illustrations, 4 tables.)

Ray K. Daily.

Enciso, E. M. Choline in the treatment of serpiginous corneal ulcer. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Jan., pp. 26-32.

Eight brief case histories are reported to demonstrate the value of choline in checking the progress of a serpiginous ulcer, in dissolving hypopyon, and in producing a cure with a minimum of cicatrization. The combination of choline and mercurochrome is particularly effective, the combination intensifying the staining properties of mercurochrome and the penetrating power of choline.

Ray K. Daily.

Favaloro, G. Introduction to the study of the physiology and primary pathology of the lamino-endothelial layer of the anterior chamber of the human eye. *Boll. d'Ocul.*, 1944, v. 23, Oct.-Dec., pp. 229-242.

Synthetizing all physiologic, experi-

mental, and pathologic phenomena that he had evaluated in his dissertation, the writer states that although the cornea is formed by three layers of different embryologic origin these strata are so intimately related structurally and functionally as to be interdependent in their pathologic reactions. The parenchyma situated between the two principal protective layers establishes the means of the relationship. The primary pathologic changes of the Descemet endothelial layer became manifest as dystrophic, degenerative, and inflammatory lesions. These lesions, an "endotheliosis" and an "endothelitis," should be emphasized as the subject of a new chapter in ocular pathology. (Bibliography.)

Melchior Lombardo.

Franceschetti, A., Sarasin, R., and Balovoine, C. Bucky's rays or Grenz-rays in ophthalmology. *Ophthalmologica*, 1946, v. 111, April-May, pp. 302-306.

Bucky's rays occur in the spectrum between the X rays and the ultra-violet rays. Their outstanding physical characteristic is their absorbability. This explains their value in skin diseases and superficial corneal lesions. The application to the cornea is direct for three or four minutes and the adjoining tissues are protected by paper only. The dosage recommended varies from 70R (Monjukowa) to 150R (Krasso). Three to four treatments are enough.

Bucky's rays are recommended for intractable corneal inflammations such as disciform keratitis, herpes zoster, ophthalmicus, and recurrent corneal ulcers. (References.)

Alice R. Deutsch.

Gardiner, P. A. Relation of corneal vascularisation and conjunctival trans-

parency to general disease. *Brit. Jour. Opth.*, 1946, v. 30, April, pp. 225-232.

The author presents a statistical study to show that the presence of corneal vascularisation or of conjunctival transparency is associated with general chronic illnesses. Morris Kaplan.

Gruber, Max. *Cornea verticillata*. A simple, dominant variation of the human cornea. *Ophthalmologica*, 1946, v. 3, Feb.-March, pp. 120-129.

A rare, hereditary corneal anomaly, characterized by microscopic, punctate, brownish opacities in Bowman's membrane, arranged in irregularly placed chains which originate from an eccentric point and form whirls is described. In a family, affected with this anomaly no disturbance of function was present. (1 table, references.)

Alice R. Deutsch.

Halbertsma, K. T. A. *Staphyloma sclerae verum peripapillare congenitum*. *Ophthalmologica*, 1945, v. 110, Sept.-Oct., pp. 206-211.

The author describes congenital peripapillary staphyloma that he chanced to see in a girl, six years of age. She had bilateral myopia (3 D.) and the visual acuity was markedly reduced in both eyes. The field of vision was normal, except for an irregular blind spot. The tension and motility were normal in both eyes. The differential diagnosis is discussed in view of the congenital abnormalities of the disc; the anomaly is rare as there are only 10 cases to be found in the literature. (1 figure, references.)

F. Nelson.

Jaume, G. C. *Blue sclera and parenchymatous keratitis*. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, March, pp. 238-244.

Parenchymatous keratitis is reported in a woman, 21 years of age, with positive luetic serologic reactions. Seven members of three generations in her family had parenchymatous keratitis, blue scleras, recurrent fractures, and deafness. The history of the pathogenesis of these inherited conditions is briefly reviewed. Ray K. Daily.

Katzin, H. M. *Aqueous fibrin fixation of corneal transplants in the rabbit*. *Arch. of Opth.*, 1946, v. 35, April, pp. 415-420.

Corneal grafts were performed in rabbits, using fibrin formed in the anterior chamber as the only fixing agent. The formation of fibrin was first inhibited by the intravenous injection of heparin. When fibrin formation was desired, thrombin that contained globulin was introduced into the anterior chamber and on the surface of the graft. This resulted in the prompt formation of a dense layer of fibrin. The technique used is described. The grafts held in 86 percent of 37 eyes and remained clear in 48 percent. (2 illustrations.)

John C. Long.

Lopez, P. M. *A rare type of keratitis*. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, April, pp. 252-256.

The principal features of the three cases, all encountered in children, are a primary, untreated, unilateral, dry, eczematous lesion in the retro-auricular sulcus, and a subsequent unilateral, superficial, infiltrating keratitis, unassociated with conjunctivitis. The general examination of the children was entirely negative. The skin lesion was found to be caused by the streptococcus, and the keratitis, after failing to respond to the usual treatment for ulcerative keratitis in children, cleared up

when general and local antistreptococcus therapy was instituted.

Ray K. Daily.

Lowenstein, A. A contribution to the pathology of Bowman's membrane. *Brit. Jour. Ophth.*, 1946, v. 30, June, pp. 317-323.

Of the tissues of the cornea Bowman's membrane has the slowest metabolism. In those conditions inhibiting metabolism of the cornea, such as glaucoma, hypertensive retinopathy and various injuries, this membrane suffers first and most. Calcification and various types of degeneration of Bowman's result. A histological study of these changes is presented. (12 illustrations.)

Morris Kaplan.

Matteucci, P. Corneal lesions in Hodgkin's Disease. *Riv. di Oftalm.*, 1946, v. 1, Feb., pp. 85-93.

The lacrimal glands, the lids, orbital tissues, conjunctiva, and, rarely, the cornea may be affected in Hodgkin's disease. Fundus lesions are more common. The scarcity of reticulo-endothelial elements in the ocular tissues may explain the rare occurrence of ocular complications, although Gasteiger and Ciotola found cellular elements in the cornea that resemble reticulo-histiocytes. A woman 27 years of age, who had been under treatment for a typical Hodgkin-Sternberg disease for four years, developed photophobia and lacrimation and a bilateral marginal keratitis with definite hypesthesia. Etiologic investigations, including inoculation into a rabbit's cornea, failed. The keratitis did not respond to the usual local treatment. X-ray treatment, applied to the glandular masses of the patient's neck, was followed by improvement of the corneal lesions. Simi-

lar experiences have been reported by Sachs (1928), Lagrange (1932), and Morax (1932). The corneal ulcers sometimes resembled herpetic keratitis. (1 colored plate, references.)

K. W. Ascher.

McArevey, J. B. A statistical inquiry into the incidence of phlyctenular disease in Dublin. *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, pp. 279-299.

The author selected three periods for comparing the incidence of the disease: the war period 1915-18, a normal period, 1936-38, and the present war, 1939-41. The trend of the disease increased during both war periods and was greatest in the areas of poor housing associated with poverty.

The sex and age distribution was alike in all periods. The disease occurred predominantly in females. Infants of both sexes one to four years of age showed an increased incidence during the period 1939-41 as compared to the 1915-18 period.

There was a gradually rising incidence from March to July, decreasing from September to December.

The type of the disease over the whole ten year period showed 25 percent of the corneal type, 22 percent limbal and 19 percent conjunctival phlycten. The phlyctenular keratitis was the usual disease of the infant, limbal of the young adult and the conjunctival phlycten, the least common, was associated with the better nourished child or young adult with active tuberculosis. Eighty-five percent of the patients had one attack in the period 1936-41 and 27 percent had attacks that persisted 40 days or more. Beulah Cushman.

O'Donovan, W. J., and Michaelson, I. C. Epidemic keratoconjunctivitis as-

sociated with skin lesions. *Brit. Jour. Ophth.*, 1946, v. 30, April, pp. 193-204.

The authors compare 33 cases of epidemic keratoconjunctivitis with 33 cases of concurrently seen keratoconjunctivitis associated with skin lesions, especially seborrhea of scalp and face. It was decided that the two eye conditions were identical although those in the latter series were more severe and more prone to complications. An analogy is suggested between the skin lesions associated with keratoconjunctivitis and those associated with herpes of the cornea. (3 diagrams, 8 illustrations.)
Morris Kaplan.

Palomar, A. P. Sato's posterior partial keratoplasty in the treatment of keratoconus. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, June, pp. 427-433.

The keratotomy is made with a short discission knife, which is introduced at the limbus, and passed across the anterior chamber to the opposite pupillary border. The handle of the knife is then depressed, the blade cutting horizontally across the cornea, through the endothelium, Descemet's membrane, and part of the corneal parenchyma. A compressive bandage is worn for two months. Sato claims that the cicatrization flattens the corneal cone. The author's first patient, examined nine months after the operation, was found to have the keratoconus flattened, and vision was improved from 1/14 in the right eye, and 1/22 in the left, to 3/10 in each eye. In the second patient with keratoconus in the left eye, examinations six and nine months after the operation revealed a flattening of the corneal cone, and a visual acuity improved from 1/15 to 1/4.

Ray K. Daily.

Rea, R. L. Arsenic keratoconjunctivitis. *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, pp. 222-223.

A patient took nine vaginal suppositories by mouth by mistake over a period of four days. Acute arsenical poisoning appeared after four days with an acute dermatitis and keratoconjunctivitis evidently due to sensitivity to arsenic. It responded to treatment with benzedrine.
Beulah Cushman.

Reese, Maj. F. M. Edema of corneal epithelium caused by atabrine. *Bull. Johns Hopkins Hosp.*, 1946, v. 78, June, p. 325.

The author reports case histories of three patients who had similar corneal epithelial changes attributable to atabrine. In each case, there was epithelial edema, causing reduced visual acuity, with no pericorneal injection, no fluorescein staining, and no associated symptoms other than the blurred vision.

All three patients had been receiving atabrine in dosages in excess of 0.1 gram per day (the "suppressive dose"). All three recovered completely when the atabrine was withdrawn, and in each instance a severe recurrence of the corneal edema was precipitated within three to six days by renewed use of the drug. Complete recovery took place in 20 to 25 days after completely withdrawing the atabrine. There were no residual corneal changes.

Benjamin Milder.

Rintelen, F. Etiology and therapy of the so-called keratoconjunctivitis epidemica. *Ophthalmologica*, 1946, v. 3, Feb.-March, pp. 108-111.

The clinical diagnosis of epidemic keratoconjunctivitis can be made only with the slitlamp. The epidemiology, etiology, and the mode of transmission

are unknown. A virus that is related to the herpes virus may be the cause, therefor the author recommends abrasion of the corneal epithelium and cauterization with iodine. This treatment was successful in three patients.

Alice R. Deutsch.

Rintelen, F. Penicillin therapy of serpiginous ulcer. *Ophthalmologica*, 1946, v. 3, Feb.-March, pp. 102-107.

The author stresses the importance of smears in serpiginous ulcer of the cornea as a guide in chemotherapy. He reports a case of severest serpiginous ulcer. *Staphylococcus aureus* was found and the eye improved remarkably under local penicillin therapy only.

Alice R. Deutsch.

Robles, E. R. New observations on keratitis caused by alcohol fumes. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, April, pp. 257-261.

The author describes an acute keratitis with severe irritative symptoms, without secretion, caused by fumes of alcohol from a shampoo. The shampoo was used the evening before the onset of the ocular symptoms. The objective lesion consists of a circular or oval, central or slightly decentered corneal erosion. Robles believes that the alcohol fumes dry the corneal epithelium, which exfoliates the next day, and produces the clinical picture described.

Ray K. Daily.

Sellas, J. and Casanovas, J. Herpetic keratitis as an industrial accident. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, April, pp. 262-272.

A review of the literature on the role of trauma in the etiology of herpetic keratitis, and the problem of compensation is presented. Reference is made to the work of Gruter, Schieck, and Amman. The authors take a careful

history of each injury, examine the patient on the day of the injury, and keep a carefully charted record of the extent and progress of the traumatic lesion. Herpetic lesions that appear earlier than the second day after the injury are regarded as pre-existent to the injury. Herpes that develops after the second day and within six months after injury is regarded traumatic. A recurrence of a keratitis following an injury in a patient with a history of herpetic keratitis is also regarded traumatic.

Ray K. Daily.

Sorsby, A., and Symons, H. M. Amniotic membrane grafts in caustic burns of the eye. *Brit. Jour. Ophth.*, 1946, v. 30, June, pp. 337-345.

Extraordinary results were obtained in 30 cases of second degree caustic burns of the eye, 22 of which were due to lime. The eyes were first treated with penicillin and a graft was applied, preferably on the day of the accident. The graft consisted of dried, fat-free amniotic membrane folded over on itself several times. It was made to cover the entire burned area and was held in place with black silk sutures. Both eyes were bandaged for 48 hours. At the end of that time the graft was transparent and invisible. The burnt corneas did not stain and the conjunctivas were white. Sutures were removed on the third or fourth day and the eyes left open. Complications and sequelae were almost nonexistent and the vision was most satisfactory. The authors suggest that more was involved than a simple mechanical protection; perhaps some specific biologic, therapeutic action occurs. (References.)

Morris Kaplan.

Streiff, E. B. and Zwahlen, P. Band-shaped corneal degeneration in one

family. *Ophthalmologica*, 1946, v. 3, Feb.-March, pp. 129-134.

There are three forms of bandshaped corneal degeneration. The traumatic form is caused by a prolonged and constant chemical irritation. The secondary variety, follows severe intraocular diseases such as uveitis or glaucoma. The primary form appears in a senile and infantile variation, is very rare, and belongs to the familial corneal degenerations.

The authors report the clinical history and findings in three eyes of the third group and a pathological description of one of the corneas in which a perforating keratoplasty was performed. (2 figures, references.)

Alice R. Deutsch.

Sykes, E. M. Fungus infection of the cornea; a case report of keratomycosis due to monilia. *Texas St. J. Med.*, 1946, v. 42, Sept., pp. 330-332.

Three days after a foreign body had been projected against his eye this patient developed a linear dendritic type of ulcer in the center of the cornea. There was marked congestion, the ulcer was shallow and undermined, and the floor seemed covered with a thin gray adherent membrane. The aqueous was relucant. Scrapings from the ulcer revealed *Monilia albicans*, which grow on Sabouraud's medium. A saturated solution of potassium iodide (90 drops daily) was prescribed and all inflammatory symptoms disappeared in two weeks. A short review of the literature is given. (2 figures.)

I. E. Gaynon.

Thomas, C. I. Preservation of corneal tissue for transplation, *Arch. of Ophth.*, 1946, v. 36, Sept., pp. 321-327.

With the advent of the corneal transplantation operation, there has been a

gradual intensification of interest in the donor material to be used for this operation. The institution of the Eye Bank for Sight Restoration to supply adequate material for this operation is a step forward, for this organization facilitates a rapid distribution of donor material to the proper place. However, there are widespread misconceptions.

A series of eyes was studied to determine the efficacy of various mediums that might be useful in the preservation of corneal tissue. Isotonic solution of sodium chloride, Hartmann's solution, Hartmann's solution and 5-percent dextrose, plasma, oxygenated plasma, and freezing agents, such as liquid nitrogen and sodium pentothane (isopentane) were used.

Corneal tissue will remain clear and of normal thickness and can be used suitably for transplantation for as long as three days. After three days there may be areas of transplanted cornea that tend to retain transparency, but tissue kept for one week becomes uniformly opaque. For keeping corneal tissue clear, a solution may be used that is as nearly isotonic with the body fluids as possible, for example, saline solution, Hartmann's solution, or blood plasma.

Corneal tissue to be used for transplantation should be obtained from a fresh specimen and used within a relatively short period in order to obtain the best surgical results.

R. W. Danielson.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Amsler, M., and Huber, A. Methods and first clinical results of studies of the blood-aqueous barrier. *Ophthal-*

ologica, 1946, v. 3, Feb.-March, pp. 155-176.

The authors describe a new method for examining the blood-aqueous barrier. They inject fluorescein intravenously and check the appearance of the dye in the anterior chamber with the lowest power of the slitlamp. The beam of light in the anterior chamber is reduced in intensity to such a degree that no green color can be observed. The current to the lamp is measured in amperes and the relationship between amperes and the absolute fluorescein concentration has been experimentally calibrated. Those figures for concentration of fluorescein and the time interval are recorded in graphs. The curves are characteristic for normal and pathologic conditions not only in the eyes but also for the body as a whole. (22 figures, references.)

Alice R. Deutsch.

Amsler, M., and Verrey, F. Fuchs's heterochromia and vascular fragility. *Ophthalmologica*, 1946, v. 31, Feb.-March, pp. 177-181.

After 1200 diagnostic punctures of the anterior chamber the authors were convinced that no clinical reaction follows this procedure. However in 18 patients with Fuchs's heterochromia a delicate hyphema regularly followed diagnostic paracentesis, probably as a result of local fragility of the vessels. It did not occur in six patients with heterochromia of the sympathetic type. (4 figures.)

Alice R. Deutsch.

Bonnet, P., Paufigue, L., and Bonamour. Central serous choroiditis. *Arch. d'Opht.*, 1946, v. 6, no. 2, pp. 129-144.

The authors state that the first example of this disease in France was described in 1934 and that since then

only a few scattered cases have been reported. They point out that the condition has been described under a variety of names, such as "vesicular edema of the macula," "detachment of the macula," "angioneurotic central retinitis," "macular edema with partial detachment of the vitreous," etc. They conclude that the ophthalmoscopic picture of the disease is extremely characteristic and agree that the name "central serous choroiditis," given to it by Japanese authors, adequately describes it. They believe that the choroidal nature of the condition is indicated by the insignificance of the visual symptoms which are usually due to a transient hyperopia.

After a complete description of the ophthalmoscopic appearance of the various stages of the disease, the authors describe the visual disturbances and field changes. They note that there is generally an oval paracentral scotoma above the fixation point and that the condition is generally bilateral although the second eye may not become involved for months or even years after the first. They note that the evolution of the choroiditis is extremely variable. Some heal in several weeks or months; in exceptional cases the condition may last for years. Recurrences are common. They note that the condition occurs most frequently in young adults, particularly men. In a discussion of etiology they discard syphilis as a factor but consider tuberculosis and focal infection as possible causes. They make no mention of the angiospastic theory of causation which has been advanced, particularly by Gifford. The article concludes with a detailed account of seven observations of the disease, well illustrated by one fundus plate in color and eight in black and white.

Phillips Thygeson.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. Louis Samuels Deitchman, Youngstown, Ohio, died September 4, 1946, aged 52 years.

Dr. George Baigerie Jobson, Franklin, Pennsylvania, died October 21, 1946, aged 77 years.

Dr. Frank Hermance Lasher, Brooklyn, New York, died in October, aged 63 years.

Dr. Simons Ravenel Lucas, Florence, South Carolina, died October 5, 1946, aged 61 years.

Dr. Charles B. Williams, Mineral Wells, Texas, died September 4, 1946, aged 72 years.

SOCIETIES

The Section of Ophthalmology, New York Academy of Medicine, announces its centennial meeting for Monday evening, March 17th, at 8:15 o'clock. The following papers will be presented: "Past and Future Progress in American Ophthalmology," by Dr. Derrick Vail, chairman, Department of Ophthalmology, Northwestern University, Chicago; "Notes on the History of Ophthalmology in Canada," Dr. John A. MacMillan, professor of ophthalmology, McGill University, Montreal; "History of the American Board of Ophthalmology," Dr. S. Judd Beach, secretary, American Board of Ophthalmology, Portland, Maine; and "New York's Contribution in the Development of Ophthalmology in This Country," Dr. Bernard Samuels, professor emeritus, Department of Ophthalmology, Cornell University Medical School, New York.

The third annual Sanford R. Gifford Memorial Lecture was given by Dr. Frederick C. Cordes, San Francisco, at the January 20th meeting of the Chicago Ophthalmological Society. Dr. Cordes' subject was: "Types of Congenital Cataracts."

At the 16th annual Spring Clinical Conference of the Dallas Southern Clinical Society, Dr. Francis Fralick, Ann Arbor, Michigan, and Dr. Leo H. Garland, San Francisco, will participate in the program. The meeting will open on March 17th and will continue through March 20th.

The Los Angeles Society of Ophthalmology and Otolaryngology has appointed the following officers for the year, 1947: president, Dr. William D. Donohue; vice-president, Dr. Leland G. Hunnicutt; secretary-treasurer, Dr. K. C. Brandenburg; committeeman, Dr. Benton N. Colver. Meetings will be held the fourth Monday of

each month from September to May inclusive at 6 P.M. at the Los Angeles County Medical Association building, 1925 Wilshire Boulevard, Los Angeles.

MISCELLANEOUS

EYE BANK TO OPEN

A branch of the Eye Bank for Sight Restoration, Inc., is being opened at the Massachusetts Eye and Ear Infirmary, Boston. The bank is said to be the second such affiliated unit to be established. Persons donating their eyes after death for use in the corneal-transplant operation are asked not to make the gift a part of their wills, as a will is not effective immediately. Eyes must be enucleated by at least one hour after death. These medical technicalities make it necessary for the donor to be in a hospital at the time of death. For this reason the donation is made beforehand on a special blank sent by the eye bank on request.

SCHOLARSHIPS AWARDED

Four scholarships for advanced study of eye diseases at New York University College of Medicine were announced on November 27, 1946. The physicians selected for the \$500 awards are: Dr. Edward Danforth, Bainbridge, New York; Dr. Charles P. Goldsmith, Cata-sauqua, Pennsylvania; Dr. Jonathan L. Harris, Elberon, New Jersey, and Dr. Hugh E. McGhee, Jeffersonville, New York. All are postgraduate students at the College of Medicine, and are specializing in ophthalmology. The Eye Conservation Fund, Inc., of the New York Lions Club initiated the scholarship plan last spring with a gift of \$2,000 to the college. Mr. Ernest R. Fryxell, chairman of the Eye Conservation Fund, stated that the Lions Club will provide four scholarships annually for advanced study of eye diseases at New York University.

REFRESHER COURSE

The Department of Ophthalmology of Washington University School of Medicine, St. Louis, has announced that this year its annual Refresher Course will be given from June 9th through June 28th. The course is purely didactic, consisting of 98 hours of lectures. The subjects covered will include Corneal Diseases, Ocular Therapy, Surgery, Anatomy and Pathology, Embryology, Fever Therapy, Neuro-Ophthalmology, Headache, Allergy, Office and Laboratory Procedures, Industrial Ophthal-

mology, Radiology in Ophthalmology, and Dermatology in Ophthalmology.

The tuition is \$150.00 and the only prerequisite for those taking the course is a minimum of one year's training in Ophthalmology. The course is designed to refresh the busy ophthalmologist, to review candidates for the American Board of Ophthalmology examinations, and to enable the returned physician-veteran to reacquaint himself with his specialty.

Further details may be obtained from Richard G. Scobee, M.D., Director of Graduate Training in Ophthalmology, Washington University School of Medicine, 640 South Kingshighway Boulevard, St. Louis 10, Missouri.

GILL HOSPITAL COURSE

The first three days of the 20th annual Spring Graduate Course to be held at the Gill Memorial Eye, Ear, and Throat Hospital, Roanoke, Virginia, April 7th to 12th, will be devoted to subjects in the fields of Otolaryngology, Laryngology, Facio-Maxillary Surgery, Bronchoscopy, and Esophagoscopy. Beginning at 8 A.M. on Thursday, April 10th, the following program of particular interest to ophthalmologists will be presented.

Thursday, April 10th

8:00 to 9:00 A.M.

Clinic conducted by Dr. Eugene M. Blake, Clinical Professor of Ophthalmology, School of Medicine, Yale University, New Haven, Connecticut.
Subject: "The Pathology of Glaucoma."

9:00 to 10:00 A.M.

Clinic conducted by Dr. William T. Hunt, Associate Professor of Ophthalmology, Jefferson Medical College, Philadelphia, Pennsylvania.
Subject: "Essential Points in Routine Refraction."

10:00 to 11:00 A.M.

Clinic conducted by Dr. Arthur J. Bedell, Emeritus Professor of Ophthalmology, Albany Medical College, Albany, New York.
Subject: "Retinopathy of Hypertension."

11:00 to 12:00 A.M.

Clinic conducted by Dr. A. J. Ballantyne, Professor of Ophthalmology, Emeritus, Glasgow University, and President of Ophthalmological Society of the United Kingdom, Glasgow, Scotland.
Subject: "The Ocular Manifestations of Diabetes Mellitus."

12:00 to 1:00 P.M.

Clinic conducted by Dr. R. Townley Paton, Surgeon Director at the Manhattan Eye, Ear and Throat Hospital, New York, New York.
Subject: "Corneal Surgery, Particular Reference to Corneal Transplant." Illustrated with Lantern Slides and Motion Pictures.

1:00 to 2:30 P.M.—LUNCHEON AT HOTEL PATRICK HENRY

Clinic conducted by Dr. Arthur J. Bedell.
Subject: "Fundus Changes in Myopia."

2:30 to 3:30 P.M.

Clinic conducted by Dr. A. J. Ballantyne.
Subject: "Injuries of the Eye by Blunt Objects."

3:40 to 4:30 P.M.

Clinic conducted by Dr. William T. Hunt.
Subject: "Ocular Therapeutics."

4:30 to 5:30 P.M.

Clinic conducted by Dr. Eugene M. Blake.
Subject: "Choice of Operations in Glaucoma."

7:30 to 8:30 P.M.

Motion Picture Demonstration on "Surgery of the Eye," and presentation of Patients with Unusual Clinical Interest by Dr. E. G. Gill and the Staff of the Hospital.

8:30 to 9:30 P.M.

Clinic conducted by Dr. R. Townley Paton.
Subject: "Corneal Surgery, Particular Reference to Corneal Transplant." Illustrated with Lantern Slides and Motion Pictures. (Continued).

Friday, April 11th

8:00 to 8:40 A.M.

Clinic conducted by Dr. William P. Beetham, Surgeon at the Massachusetts Eye and Ear Infirmary, and Instructor in Ophthalmology, Harvard Medical School, Boston, Massachusetts.
Subject: "Diabetic Retinopathy."

8:40 to 9:20 A.M.

Clinic conducted by Dr. Eugene M. Blake
Subject: "Unilateral Exophthalmos."

9:20 to 10:05 A.M.

Clinic conducted by Dr. Arthur J. Bedell.
Subject: "Anomalies of the Fundus."

10:05 to 10:45 A.M.

Clinic conducted by Dr. A. J. Ballantyne.
Subject: "Birth Injuries of the Eye."

10:45 to 11:30 A.M.

Clinic conducted by Dr. Bernard Samuels, Professor of Ophthalmology, Emeritus, Cornell University Medical School, New York, New York.
Subject: "The Histology of the Eyeball with Special Reference to Inflammation and Surgery."

11:30 A.M. to 12:15 P.M.

Clinic conducted by Dr. Raymond E. Meek, Surgeon, New York Eye and Ear Infirmary, New York, New York.
Subject: Detachment of the Retina and the Surgical Treatment."

12:15 to 1:00 P.M.

Clinic conducted by Dr. William T. Hunt.
Subject: "The Management of the Lateral 'Phoria' and 'Tropia' Cases."

1:00 to 2:30 P.M.—LUNCHEON AT HOTEL PATRICK HENRY

Clinic conducted by Dr. Eugene M. Blake.
Subject: "Fundus Changes in Blood Dyscrasias."

2:30 to 3:15 P.M.

Clinic conducted by Dr. Bernard Samuels.
Subject: "The Histology of the Eyeball with Special Reference to Inflammation and Surgery." (Continued).

3:15 to 4:00 P.M.

Clinic conducted by Dr. A. J. Ballantyne.
Subject: "Some Intractable Diseases of the Cornea and Conjunctiva."

4:00 to 4:45 P.M.

Clinic conducted by Dr. Raymond E. Meek.
Subject: "Minor Surgery of the Eyelids and Conjunctiva."

4:45 to 5:30 P.M.

Clinic conducted by Dr. Arthur J. Bedell.
Subject: "Differential Diagnosis of Optic Neuritis from Papilledema."

7:30 to 8:30 P.M.

Clinic conducted by Dr. William P. Beetham.
Subject: "The Management of Some of the External Diseases of the Eye."

8:30 to 9:30 P.M.

Clinic conducted by Dr. William T. Hunt.
Subject: "The Near Point Examination."

Saturday, April 12th

8:00 to 9:00 A.M.

Clinic conducted by Dr. Raymond E. Meek.
Subject: "Cataract Extraction."

9:00 to 10:00 A.M.

Clinic conducted by Dr. William P. Beetham.
Subject: "Keratoconjunctivitis Sicca."

10:00 to 11:00 A.M.

Clinic conducted by Dr. Bernard Samuels.
Subject: "The Histology of the Eyeball with Special Reference to Inflammation and Surgery." (Continued).

11:00 to 12:00 A.M.

Clinic conducted by Dr. A. J. Ballantyne.
Subject: "The Etiology and Differential Diagnosis of Rapid Loss of Vision."

12:00 to 1:00 P.M.

Clinic conducted by Dr. Raymond E. Meek.
Subject: "The Surgical Management of Crossed Eyes."

1:00 to 2:30 P.M.—LUNCHEON AT HOTEL PATRICK HENRY

Clinic conducted by Dr. William P. Beetham.
Subject: "Crystalline Lens in Diabetes."

2:30 to 3:30 P.M.

Clinic conducted by Dr. Bernard Samuels.
Subject: "The Histology of the Eyeball with Special Reference to Inflammation and Surgery." (Continued).

3:30 to 4:30 P.M.

Clinic conducted by Dr. A. J. Ballantyne.
Subject: "The Non-Surgical Treatment of Cataract and of the Cataract Patient."

LOS ANGELES MID-WINTER CONVENTION

The 16th annual Mid-Winter Post-Graduate Clinical Convention in Ophthalmology and Otolaryngology was held January 20th to 31st in Los Angeles. Again this year, following the John Finch Barnhill tradition, the special course in "Applied Anatomy and Cadaver Surgery of the Head and Neck," was given from January 31st to February 4th.

The teaching staff included: Dr. Luzius Ruedi, Professor of Otolaryngology, University of Bern, Bern, Switzerland; Willi Furrer, Physicist in Acoustics, Federal Institute of Technology, Zurich, Switzerland; Dr. William L. Benedict and Dr. Henry P. Wagener, Mayo Clinic, Rochester, Minnesota; Dr. Sam E. Rob-

erts, University of Kansas, Kansas City, Missouri; Dr. Cecil S. O'Brien, University Hospital, Iowa City, Iowa; Dr. Alexander S. MacMillan, Massachusetts Eye and Ear Hospital, Boston; Dr. Samuel Salinger, Loyola University School of Medicine, Chicago; Dr. Kenneth C. Swan, University of Oregon Medical School, Portland; Dr. Dohrmann K. Pischel, Stanford University Medical School, San Francisco; Dr. David O. Harrington, University of California Medical School, San Francisco; Dr. Meyer Wiener, Washington University School of Medicine, Saint Louis; Dr. Rea E. Ashley, Stanford University Medical School, San Francisco; Dr. Ben H. Senturia, Washington University School of Medicine, Saint Louis; Dr. Clinton H. Thienes, University of Southern California, Los Angeles; Dr. Arthur C. Jones, Boise, Idaho; Dr. J. Mackenzie Brown, Los Angeles; Dr. Samuel A. Crooks, College of Medical Evangelists, Loma Linda, California; Dr. George C. Griffith, University of Southern California, Los Angeles; and Dr. Simon Jesberg, Los Angeles.

PERSONALS

Dr. Arthur Linksz gave a lecture and demonstration course in "Physiological and Geometrical Optics," at the Manhattan Eye, Ear, and Throat Hospital during January.

Dr. Wendell L. Hughes, Hempstead, New York, and Dr. Thomas D. Allen, Chicago, were among the speakers at the Postgraduate Medical Assembly of South Texas held in Houston, December 3 to 5, 1946.

DIRECTORY ANNOUNCEMENT

The American Board of Ophthalmology wishes to announce that a directory of all diplomates to January 1, 1947, will be published shortly. This directory will be arranged alphabetically and geographically. No biographical material will be included. Every effort will be made to make this directory accurate. Diplomates who have not already done so should notify the Board office, Cape Cottage, Maine, at once stating the name and address exactly as they wish them listed. Diplomates are also requested to keep the Board office informed of all changes of address so that the files can be kept up-to-date. The price for the directory will be three dollars, postpaid.

EXAMINATION DATES SET

The 1947 examinations of the American Board of Ophthalmology will be: Atlantic City, June 8th to 13th; Philadelphia, June 13th to 16th; Chicago, during the week of October 8th.

THE INFLUENCE OF HYPERSENSITIVITY ON
ENDOGENOUS UVEAL DISEASE*

THE JACKSON MEMORIAL LECTURE

ALAN C. WOODS, M.D.

Baltimore, Maryland

It is my privilege tonight to deliver the Jackson Memorial Lecture. I am deeply appreciative of the high honor. I knew Dr. Jackson only as one of the great stalwarts of ophthalmology. He was one of the leaders of his day. To my mind he achieved his high position through the happy combination of many sterling qualities: a searching and analytical mind, a tireless and meticulous attention to detail—but details were never allowed to obscure his prime objective—a rugged honesty, and above all a kindly love for his fellow man. Although it was never my good fortune to serve under him, or be trained directly by him, no man who received his training in the period I did could help but be influenced for the better by Dr. Jackson's example and teachings. I freely acknowledge the debt.

The subject I have chosen for this lecture may at first glance appear somewhat foreign to the subjects in which Dr. Jackson was preëminently interested. Yet I excuse myself this seeming digression by recollecting a remark that Dr. Jackson once made to me. It was some years ago at a medical convention in Texas, when I had

delivered a lengthy and probably quite dull lecture on the relation of immunity in syphilis to syphilitic disease of the eye. After a perfunctory discussion had come to a close and the business had moved on to the next paper, Dr. Jackson sought me out and went out of his way to thank me for the paper. When I told him I was afraid it was a little foreign to the general interest of the audience, he told me frankly that he was well-aware of this, but he believed it was a healthy step to present such subjects to ophthalmologists, and that he, for one, trusted I would continue to do so. I have never forgotten his kindness or the sincerity of his advice. So with this pleasant memory, I have less temerity than I would otherwise have in discussing the subject of this paper—"The Influence of Hypersensitivity on Endogenous Uveal Disease."

Primarily there is an enormous confusion in the terminology of the hypersensitive reaction. This applies especially to the word "allergy." As used originally by von Pirquet it was defined as an altered reaction capacity of the organ. Its meaning was gradually extended by von Pirquet to include the general changes that occur with any stimulus, even those which might not be the result of malignant disease. The term has entered the minds of most

* Delivered on October 16, 1946, at the convention of the American Academy of Ophthalmology and Otolaryngology. From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University.

allergy is synonymous with acquired hypersensitiveness, it is used with a wide variety of meanings. Some authors limit its application to certain specific types of hypersensitivity; others use it to include all types of hypersensitiveness to foreign antigens, both bacterial or nonbacterial; and still others include in its meaning all forms of altered reaction capacity, including immunity. Rich has frankly stated that "the term 'allergy' has become so debauched by indiscriminate usage that it would be fortunate indeed if it could be dropped completely from the vocabulary of science."

This confusion of terminology is reflected in ophthalmic literature to such an extent that the terms hypersensitivity and allergy are used almost as scrap baskets or coveralls, being invoked to explain a variety of mysterious and often totally unrelated conditions for which there is no obvious explanation. Thus, we reach the final absurdity where we find a uveitis of unknown etiology attributed to an assumed allergy to an undiscovered virus! Scylla piled upon Charybdis!

Yet despite this indiscriminate and unjustified use of specific terms, and the definite gaps which exist in our knowledge, there is nevertheless a great fund of information on the hypersensitivity reaction and a generally accepted terminology. This knowledge and the terminology have recently been set forth in an orderly manner by Rich,¹ and since I know of no clearer exposition for our purposes here, we may follow his presentation.

THE TYPES OF HYPERSENSITIVITY

Two definite forms of hypersensitivity are recognized—the anaphylactic state and the hypersensitivity of infection. While there are many superficial resemblances between these two types, there are, nevertheless, differences so fundamental that they can be clearly differentiated.

I. ANAPHYLAXIS

A. The anaphylactic state is a form of hypersensitivity which results when foreign protein enters the tissues. When this hypersensitivity is once established, if small amounts of the same foreign protein are brought into contact with the sensitized tissues, either by intracutaneous injection or a patch test, a localized urticarial weal develops. If the antigen enters the circulation in sufficient quantities, various anaphylactic manifestations occur which include urticaria, "serum sickness," complete collapse, and even death. These symptoms come on promptly after the second exposure to the foreign protein and are caused by a spasmodic contraction of the involuntary smooth muscle and an increase in capillary permeability.

In addition to the local and general reactions, a focal reaction can occur in the anaphylactic type of hypersensitivity. Thus, if the initial or sensitizing injection of the foreign protein is given directly in the eye or in the cornea, and the second "intoxicating" injection is given intravenously, a sudden sharp inflammatory reaction may take place in the injected eye. This is a form of the "ophthalmic reaction" produced by protein antigens. It is manifestly due to a local increased reaction capacity of the eye, although it is not fully established to what degree this is due to a local vascular reaction dependent on the increased capillarity induced by the primary injection.

The anaphylactic type of hypersensitivity is probably produced exclusively by proteins. When it is apparently dependent on such nonprotein substances as inorganic chemicals, drugs, carbohydrates, and the like, the probable mechanism is a combination of the foreign, nonprotein material with the native protein of the body to form a new protein compound

which is foreign to the host. The anaphylactic manifestations result from an antigen-antibody reaction affecting primarily the fixed cells of the involuntary smooth muscle, the endothelium of the capillaries, and collagen fibers. While the anaphylactic reaction is characterized by edema, increased capillary permeability, congestion, hemorrhage, and spasm of the smooth muscle, it does not produce *per se* necrosis or death of the fixed cells. The anaphylactic type of hypersensitivity can be passively transferred, and is usually accompanied by the presence of specific precipitins in the body fluids.

B. The Arthus phenomenon is essentially an exaggerated local type of anaphylactic reaction. If foreign proteins, including the soluble portions of bacterial proteins, are introduced repeatedly and in small amounts into the tissues at intervals of several days instead of only once, an anaphylactic state will be produced. After sensitivity appears, the injections of the protein at first call forth the usual urticarial weal which vanishes in a few hours. But as these injections are continued, at last the introduction of a small amount of the foreign protein will produce an enduring local reaction characterized by hemorrhage, necrosis, and finally sloughing of the skin at the site of the reaction. In the case of bacterial protein, the Arthus type of hypersensitivity can be induced only by the injection of the soluble portions of the bacterial proteins, and when thus established, the phenomenon is elicited by the injection of the soluble bacterial proteins. While the Arthus phenomenon superficially resembles the reaction of the bacterial type of hypersensitivity, in that it may produce local necrosis, the fundamental mechanism is quite different. The local necrosis and death of the fixed cells in the Arthus phenomenon is not caused by a direct action on the extravascular tissue cells but is due

to an interference of their blood supply by thrombosis and rupture of the nutrient vessels.

C. The "pollen" type of hypersensitivity, which is produced not only by pollens but also by other protein agents, is quite similar to the usual anaphylactic type. It differs from it chiefly in its tendency especially to involve certain tissues, the bronchioles, nasal, and conjunctival mucous membranes, and in the fact that, although the antibody is demonstrated in the serum by passive transfer, its specific precipitins are ordinarily not demonstrable in the serum. In other respects—the immediate reaction, urticaria, erythema, smooth muscle spasms, and so forth—it is indistinguishable from the anaphylactic reaction. Since the differences are not fundamental, it may be regarded as a form of anaphylactic hypersensitivity.

II. THE HYPERSENSITIVITY OF INFECTION—BACTERIAL HYPERSENSITIVITY—THE TUBERCULIN TYPE OF HYPERSENSITIVITY

These terms are all synonymous and are used to describe a type of hypersensitivity quite different from the anaphylactic type in its various characteristics. This type of hypersensitivity can be readily induced by parenteral contact of the tissues with the living or dead bacteria, fungi, or filterable viruses, but not by any soluble antigens so far extracted from microorganisms. However, once it is established by contact with the bacterial bodies, reactions may be elicited by injection of the soluble bacterial proteins. The bacterial type of hypersensitivity is not characterized by the appearance of precipitins in the blood serum, and it cannot be passively transferred. The reactions elicited in the hypersensitive patient or experimental animal are: (a) a local, and (b) if the specific antigen is introduced in sufficient quantity, a systemic and (c) a focal reaction.

A. The local reaction. When the bacteria causing this hypersensitive state, or their soluble products, are introduced in the hypersensitive tissues, there is no immediate reaction, but a delayed reaction which comes on after some hours and reaches its maximum in 24 to 48 hours. The local reaction is characterized by erythema and edema, and in its extreme form by local tissue necrosis and sloughing. The cells of the body with the bacterial type of reaction are damaged by the contact of the antigen with the cell body, both in vitro and in vivo, and if the antigen-antibody reaction is sufficiently intense, the cells may be actually killed.

B. The systemic reaction. If the antigen is introduced in sufficient quantity, there may occur a severe systemic reaction, but unlike the anaphylactic reaction, this reaction is delayed and comes on gradually after some hours. In its mild form the systemic reaction is characterized by malaise, joint pains, fever, and so forth. In its severe form, death may ensue. The mechanism of this delayed reaction is not understood. It is variously believed that the antigen-antibody reaction may produce a toxin which damages the cells or that the cells undergo some bodily alteration which makes them capable of exerting an enzymlike activity on the antigen with the liberation of an irritant substance.

C. The focal reaction. In addition to the local and systemic reactions, a "focal" reaction may be induced if sufficient quantities of antigen are introduced. This focal reaction consists in the lighting up of any remote focus of infection caused by the specific infecting agent. Again it is a delayed reaction, coming on only after some hours.

The bacterial type of hypersensitivity differs from the anaphylactic type, therefore, in the fact that it can be produced only by introduction of the whole bacteria,

and not by soluble protein; therefore, it usually follows infection and vaccination with the bacterial body. The reaction to later introduction of the antigen is delayed and is accompanied by local inflammation, and often necrosis. There may occur also systemic and focal reactions. The site of the reaction is not limited to the involuntary, smooth-muscle capillary endothelium and collagen fibers, but is a widespread reaction in the sensitized cells of the body, and is associated with no demonstrable excess of free antibody in the circulation. The antigen-antibody reaction acts directly on the cells, causes cellular damage, and may cause death of the cells.

While anaphylactic and bacterial hypersensitivity are fundamentally different and in the main tend to be mutually exclusive, they can, nevertheless, occur together in the same individual or animal. Thus after bacterial infection, the infected body may develop not only the usual bacterial type of hypersensitivity from the protein of the bacterial body, but may also develop the anaphylactic type of sensitivity to the soluble products of the bacteria. For example, in pneumococcal infections the bacterial type of hypersensitivity to the pneumococcal protein may develop and also an anaphylactic type of hypersensitivity to the specific polysaccharide of the pneumococcus. Likewise in tuberculosis, while the injection of tuberculin or tuberculo-protein will not induce the tuberculin type of hypersensitivity, under certain conditions an anaphylactic type of sensitivity to tuberculin may develop.

III. IMMUNITY

There remains one last term to define—"Immunity." In general, immunity may be defined as an increased resistance to infection. This increased resistance may be either native to the organism or acquired by infection or inoculation. There are two main, recognized phases to the phenome-

non of immunity. The first is a humoral factor, due to the antibodies circulating in the blood stream and tissue fluids, which tend to fix, immobilize, and opsonize the bacteria, and in some infections may provoke extracellular destruction. The second is a cellular phase, centered chiefly in the mononuclear and phagocytic cells, which engulf the opsonized bacteria and either inhibit their proliferation or destroy them. In most infections, the important role of antibodies and phagocytes is readily demonstrable. In tuberculosis, the role of the circulating antibody is not as well-established as in various other infections, although it probably plays an important part.

The essential basic manifestations of acquired resistance are inhibition of the spread of bacteria and the suppression of their proliferation. In acute infections, this is accompanied by an actual destruction of the bacteria. In tuberculosis, however, while many bacilli are destroyed by the forces of acquired resistance, bacteriostasis with fixation and immobilization of the bacteria is prominent. Thus the bacilli may long remain viable, ready to proliferate and spread when the forces of resistance which hold them in check diminish and wane.

There has been much confusion on the relationship of allergy and immunity. For example, in tuberculosis, and indeed in many other infections, for years it was generally accepted that allergy (that is, a hypersensitive state) was responsible for the immunity (that is, acquired resistance)—that the hypersensitive reaction inhibited the spread of the invading specific bacteria and suppressed their proliferation. This idea was challenged by Rich and his co-workers in 1929.² In a long series of experiments by these and other investigators, it was clearly demonstrated that acquired resistance is in no way dependent on hypersensitivity. There is no actual

correlation between the two. Hypersensitive inflammation itself is incapable of preventing the spread of invading bacteria in the absence of acquired resistance. Effective acquired resistance can be established in the complete absence of any hypersensitive reaction.

Allergy (acquired hypersensitivity) and immunity (acquired resistance) should, therefore, be regarded as distinct phenomena. It should, however, be born in mind that as a result of infection or exposure to specific bacteria, both allergy and immunity tend to develop in the infected body. For example, both in clinical and experimental tuberculosis, the infected body usually develops a well-marked hypersensitivity to tuberculo-protein, while at the same time it shows a marked resistance to reinfection. This same holds true in other infections. The two phenomena, hypersensitivity and resistance, are, however, independent one of the other.

So much then for a brief summary of the clinical characteristics and fundamental differences of the two recognized types of hypersensitivity, a definition of acquired resistance or immunity, a word as to its mechanism, and its independence of any hypersensitive reaction. The main question before us is in what way the different types of hypersensitivity, both of which may follow infection, may influence endogenous uveal disease, how such influences may be suspected and detected, and how they may direct our therapeutic attack on the ocular disease.

TYPES OF ENDOGENOUS UVEITIS

Endogenous uveitis may conveniently be divided into three different groups: (1) sympathetic ophthalmia and the so-called endophthalmitis phacoanaphylactica; (2) the various metastatic purulent infections of the eye which arise from direct infection by blood-born bacteria;

(3) the usual nonpurulent uveitis, iritis, or choroiditis, which so often is recurrent, and comprises the greater percentage of all uveal disease.

While there is considerable evidence that a hypersensitive reaction is of paramount importance in both sympathetic ophthalmia and endophthalmitis phacodanaphylactica, the hypersensitivity in these diseases is dependent on the organ-specific proteins of the eye itself. This is a separate problem which has been amply discussed elsewhere, and is not germane to the present subject. Likewise, the various forms of metastatic ophthalmia, endophthalmitis, choroiditis spetica, and panophthalmitis, which result from the direct infection of the eye by bacteria carried by the blood stream, do not concern us in this discussion. In such direct infection with the usual pathogenic organisms, the process either becomes localized and walled-off with varying amounts of damage to the eye, or the infection spreads through the eye with the picture of a purulent ophthalmia. We are here concerned with the acute, the recurrent, and the chronic uveitis which constitute the usual clinical picture.

The older writers divided disease of the anterior uvea into "serous" and "plastic" iritis. To my mind, a much better terminology is "nongranulomatous" and "granulomatous," for these terms give an indication of the underlying pathologic process. In some instances it may be difficult or even impossible to make this differentiation, but as a rule the clinical pictures, as well as the underlying pathology of these two forms of inflammation, are quite different. The salient characteristics of these forms of uveitis are as follows.

Nongranulomatous uveitis. In the anterior uvea the onset is usually acute, rather than insidious, and ciliary congestion is marked with pronounced photophobia and lacrimation. The inflammatory

reaction in the iris is usually slight and is limited to loss of luster, blurring of the iris pattern, and dilatation of the capillaries. There are no nodules and but little tendency to the formation of posterior synechia unless there are repeated recurrences. The aqueous ray is usually intense due to the outpouring of serum, and there may even be a heavy gelatinous or fibrinous exudate in the anterior chamber. The deposits on the posterior surface of the cornea are small and pin-point and are composed chiefly of lymphocytes. Heavy, greasy exudates do not occur, and there is little or no tendency to capsular clouding of the lens. Koepe nodules are never observed. The course of a nongranulomatous iritis is usually short, and the eyes usually recover with amazingly few residua. Only after repeated attacks is organic damage done to the eye.

A nongranulomatous inflammation in the posterior uvea is not so typical, and the diagnosis may be difficult or impossible. The general characteristics of a nongranulomatous choroiditis are slight clouding in the vitreous, fine muscae, wide-spread and intense subretinal edema, blurring of the neuroretinal outlines, obscuration of the physiologic cup, overfilling of the retinal-venous bed, and the absence of manifest or well-defined choroidal exudates. There is little tendency to actual tissue destruction and secondary gliosis.

Granulomatous uveitis. In the anterior uvea, the onset of the granulomatous iritis is usually insidious. The cellular reaction in the tissues is greater than the vascular reaction, and the ciliary congestion is not usually severe. Organic changes take place in the iris, with thickening of the stroma from cellular infiltration, with blurring of the iris pattern, and with loss of the normal luster. Well-defined nodules or tubercles on the surface of the iris, or diffuse localized thickenings suggesting nodules

deep in the iris stroma, are sometimes present. There is a marked tendency to the formation of posterior synechiae, with greasy exudates on the anterior capsule of the lens and capsular clouding. The keratic precipitates are of the so-called "mutton fat" variety, and histologically consist chiefly of epithelioid cells. Koeppe nodules, or accumulations of epithelioid cells at the pupillary border of the iris, are not uncommon. The aqueous ray may be intense. More often, however, it is rather mild.

In the posterior uvea, the granulomatous type of inflammation is usually marked by heavy veils and exudates in the vitreous. Manifest visible exudates in the choroid are the rule and they quickly involve the overlying retina. The subretinal edema may be diffuse, but it is usually localized and limited to the portion of the fundus adjacent to the exudates. The exudates are at first ill-defined. In some cases they spread and tend to involve the entire fundus with necrosis and destruction of the choroid and retina with later secondary gliosis. In other instances, they become quickly circumscribed and limited. In either case, the essential underlying pathologic process is tissue destruction with secondary overgrowth of glial tissue. When the process is localized, as in the well-known "circumscribed plastic chorioiditis," recurrences are common, and usually take place contiguous or at the site of the earlier lesion.

In the main, nongranulomatous and granulomatous uveitis tend to be mutually exclusive, the clinical picture usually following one or the other pattern. A few cases are encountered in which differentiation is difficult, characteristics of both types appear present in the same eye—acute inflammation followed by granulomatous changes. In these cases one has the impression that both processes are present together.

ETIOLOGY OF NONGRANULOMATOUS AND GRANULOMATOUS UVEITIS

There is a definite conflict of opinion on the etiology of endogenous uveitis. This is not remarkable since there are no fluids readily available for culture or animal inoculation, and no tissue for biopsy. The etiologic diagnosis is made on clinical observation, correlation of the clinical picture with the accumulated histologic material from similar eyes, and the general study of the patient. As a result, the literature reflects the individual clinical acumen and the knowledge of clinical-histologic correlation of the various reporters and their resources for medical study of the patient. While most authors agree that the various forms of uveal inflammation are infective in nature, they admit the clinical picture is quite different from the purulent reactions usually induced by bacterial metastasis. It is assumed that in some unknown way, either by passage through the body or by the local environment in the eye, the usual action of the infecting bacteria has become modified and an atypical picture results.

A great number of ophthalmologists believe that remote foci of infection are the most important cause of uveal disease, the disease in the eye resulting either from direct bacterial metastasis, or from toxins liberated from the focus of infection. While syphilis, tuberculosis, and other systemic diseases are recognized as causes of endogenous uveitis, they are considered less important. Another group of ophthalmologists places chief emphasis on tuberculosis and the other so-called infectious granulomas as etiologic factors. Still others express a middle-of-the-road opinion. There is little differentiation in the literature between the etiology of nongranulomatous and granulomatous uveitis. In fact, these terms are not in common usage. In general, however, the type of uveitis described here as nongranuloma-

tous is usually believed to be infective in nature, caused in one way or another, by the usual common pathogenic bacteria. The causes usually recognized for granulomatous disease are syphilis, tuberculosis, brucellosis, sarcoid, lymphogranuloma venereum, and certain fungus infections. It is quite probable that other etiologic agents, viruses and unrecognized bacterial infections, may produce a similar pathologic picture—for in an appreciable percentage of granulomatous uveitis, the most thorough medical survey reveals no recognizable cause.

In recent years, it has become fashionable to speak continually of allergy as influencing and actually causing endogenous uveitis, although rarely, if ever, does there appear to be any clear concept of the type of hypersensitive reaction involved, or the mechanism thereof. However, in many cases there appears to be a close correlation between the anaphylactic state, the hypersensitivity of bacterial infection, and the various manifestations of uveitis. It is not my intention to repeat here any of the statistical or experimental studies already published on the etiology of uveitis. Rather I would present to you my overall impression on the influence of the different types of hypersensitivity on endogenous uveitis, the methods used for the detection of the hypersensitive state, and what therapeutic measures may be used to combat it.

NONGRANULOMATOUS UVEITIS

The clearest-cut examples of non-granulomatous uveitis are the recurrent iris inflammations found in association with rheumatoid arthritis and old gonococcal infections. A similar acute iritis is sometimes found following acute systemic infections and is occasionally found in association with remote foci of infection, no other obvious cause being apparent. The ocular picture in these conditions

follows the same general pattern of non-granulomatous iritis already described. The course is sometimes so stormy that an inexperienced ophthalmologist might almost despair of saving the eye, but the disease finally subsides in a relatively short time with practically no organic damage to the eye. This type of iritis is remarkably resistant to ordinary forms of treatment. Certainly in my experience neither the sulfa drugs nor penicillin appear to influence the course of the disease, although some form of heat therapy, either nonspecific protein-therapy induced hyperpyrexia or prolonged local diathermy, appears of value.

Is this type of iritis due to the actual presence of living bacteria in the tissues of the eye? My contention is that in the recurrent nongranulomatous iritis associated with rheumatoid arthritis, old gonococcal infection, and sometimes with focal infection, there is no evidence whatsoever of living bacteria in the eyes. All the evidence, both clinical and experimental, is against such a supposition and points strongly to a hypersensitive reaction being the basic cause.

INFLUENCE OF HYPERSENSITIVITY IN NONGRANULOMATOUS UVEITIS

Acute iritis. Various authors (Kolmer,³ Berens, Rothbard, Angevine, and others⁴) have commented on the routinely negative blood cultures obtained in patients with acute iritis. It is true, however, that these cultures have been made after the outbreak of the iritis, and it is still conceivable that cultures immediately prior to the onset of the iritis might have been positive. However, such specimens of the aqueous as have been examined are sterile on culture and bacteriologic examination. In my experience, not only have the blood and aqueous cultures been sterile, but animal inoculations of the aqueous, either intraperitoneal in guinea pigs or in the

anterior chamber of a rabbit's eye, have all been negative.

Experimental investigations also argue against the actual presence of living bacteria in the eye and are in favor of a hypersensitive reaction being responsible for nongranulomatous iritis. Inoculation of the eye, either by direct injection in the aqueous or by intracarotid injection, of various strains of streptococci, pneumococci, and such organisms almost invariably results in a purulent ophthalmia which may progress up to destruction of the eye, according to the virulence of the invading organism. However, if the animals are sensitized to streptococci by repeated intracutaneous injections of living organisms, or by an infected agar implant, and the organisms are later brought into contact with the eye, a nonpurulent inflammatory reaction is produced. This was first described by Derick and Swift in 1929⁵ as "the ophthalmic reaction." These authors produced the ocular inflammation in sensitized animals by corneal scarification and instillation of the organisms in the conjunctival sac. This procedure has been amplified and modified by others. It has been clearly shown that a nonpurulent iritis may be produced in animals by various forms of systemic or local sensitization and by intoxication by intravenous injection of the antigen. Specific attention has been called to the fact that the iritis so produced corresponds clinically to that observed in humans. The picture is ciliary congestion, dilatation of the iridic vessels, contraction of the pupil, and even small exudates in the anterior chamber. The course is short and acute. The inflammatory process lasts several days only and then subsides without organic residua. Histologic examination of such eyes shows cellular infiltration of the iris, chiefly by lymphocytes and plasma cells (Brown⁶). If foreign proteins, such as heterologous serums, are

used as antigens, the ocular reaction is prompt. If bacterial antigens are used, the ocular reaction is usually delayed.

The most frequent positive findings in patients with nongranulomatous iritis are evidences of rheumatoid arthritis, an old gonococcal infection with a positive gonococcus complement-fixation reaction, a small active focus of infection, or a history of a recent acute infection of some type. Syphilis, tuberculosis, or other infectious granulomas are conspicuously absent. Positive reactions for bacterial hypersensitivity are the rule in these patients. The usual diagnostic procedures to detect such bacterial hypersensitivity are the intracutaneous injections of a 1:100 dilution of killed 24- to 48-hour cultures of various common organisms—alpha streptococci, beta streptococci, nonhemolytic streptococci, *H. influenza*, gonococci and finally a 1:100 dilution of mixed streptococci. The tests are read at the end of 15 minutes for an immediate anaphylactic type reaction to the soluble bacterial products. They are read again at 48 hours for the delayed tuberculinlike reactions to the protein of the bacterial body. The delayed tuberculinlike reaction is almost constantly present, although frequently, especially in the case with an acute fibrinous or gelatinous exudate in the anterior chamber, an immediate reaction to the soluble bacterial products is also present.

A word of caution must be given concerning the interpretation of the cutaneous reactions to bacterial antigens. The bacteria concerned are all common organisms to which the average individual has been constantly exposed for years, and reactivity to the intracutaneous inoculation of these organisms may occur in normal individuals, and may be especially marked after any acute infection. Before any diagnostic significance is attached to positive reactions, it should be estab-

lished: (1) that no other obvious cause can be found to which the uveitis is attributed; (2) that the patient shows an especial and unexplained hypersensitivity to specific organisms and not to all the bacteria tested; and (3) that the specific reactions shown are greater than are found in normal control individuals. With these reservations, in my experience, positive cutaneous reactions to such bacterial antigens are of diagnostic significance in nongranulomatous uveitis.

If the clinical nongranulomatous iritis under discussion is due to bacterial hypersensitivity, immediately it may be asked: What is the mechanism whereby the hypersensitive state is produced in the eyes and how does intoxication occur?

One can only surmise the mechanism through experimental analogy. Primarily, since the reaction is usually limited to the eye and only rarely accompanied by an urticaria or any pronounced general symptoms, one must assume an increased reaction capacity of the uveal tract. It has been clearly shown that such a local, increased-reaction capacity can be evoked experimentally by direct inoculation of the eye with the antigen. Therefore, to explain the clinical picture, it may be assumed that at some time the sensitizing bacteria have directly reached the eye. This may occur during the course of any transient acute bacteremia, which is certainly not uncommon, arising either from an acute general infection, from a remote infected focus, or by absorption from an infected, or even a normal, mucous membrane or cutaneous surface. The infecting dose of organism must be so small or of such low-grade virulence that the invading organisms are readily killed off by the bactericidal action of the ocular fluids, otherwise a purulent ophthalmia would result. If there is a repetition of such a bacteremia or later absorption of the soluble products of the bacterial body,

such antigens, when they reach the eye, encounter sensitized tissue and produce a hypersensitive reaction. This is the mechanism in the experimental animal, and from what is known of the frequency of transient bacteremias and infected mucous-membrane and cutaneous surfaces in man, it is a plausible explanation for the clinical phenomenon.

Occasionally the intoxicating bacterial protein may reach the eye from the exogenous source in such concentration that it may evoke symptoms in an eye not especially hypersensitive but only participating in the general tissue hypersensitivity. This is the case in the experimental ophthalmic reaction when the eyes are sensitized as part of the general tissue reaction, and intoxication is produced by local trauma of the eye and contact with the specific antigen. An analogous picture may occasionally occur clinically. Such a clinical phenomenon appeared to be the case in a physician whose eye was accidentally exogenously infected with streptococci. Two days later, he developed an acute nongranulomatous iritis. He was found to have a high degree of hypersensitivity to the specific invading streptococcus, and no other cause for the iritis could be found.

Is the hypersensitivity responsible for such a nongranulomatous iritis of the immediate anaphylactic type or of the delayed tuberculin type? In humans there is obviously no way of determining the time relation of the antigen entering the eye to the beginning of symptoms. In experimental animals, the evidence indicates the reaction is usually of the tuberculin type if bacterial antigens are employed. Thus Derick and Swift clearly showed that the ocular and general sensitivity produced by streptococcus antigens was of the delayed type, and the ophthalmic reaction came on 48 hours after the corneal scarification. Brown reported that

in his sensitized animals the first signs of iritis produced by intravenous injection of bacterial antigens were observed only after five hours. In MacLean's experiments, where the iritis was produced by intravenous intoxication, the reaction came on from 24 to 48 hours after the last intravenous injection. However, if foreign serums are used as the sensitizing antigens, the anaphylactic type of hypersensitivity results. This was first demonstrated by KümmeI in 1910,⁷ who found iridocyclitis with exudation in the anterior chamber six hours after intravenous injection of the foreign serum in animals previously sensitized by intraocular injection. However, this iritis was so marked at the end of six hours that it is obvious the first symptoms must have occurred much earlier. Such immediate reactions when foreign serums were used have been found by various other investigators (Wessely,⁸ Krusius⁹).

An anaphylactic type reaction in the eye was also shown by an experiment I did in 1916.¹⁰ In this experiment, the eyes of dogs sensitized by systemic injection of horse serum were later perfused with defibrinated blood. When horse serum was added to the perfusion fluid, there was an immediate contraction of the pupil, together with conjunctival and pericorneal congestion and the occurrence of petechial hemorrhages throughout the fundus. This appeared to be an example of spasmodic contraction of sensitized smooth muscle and of increased capillary permeability produced in eyes with the anaphylactic type of hypersensitivity on contact with the specific antigen.

It is apparent, therefore, that in experimental animals either the delayed bacterial type or the immediate anaphylactic type of hypersensitivity may be produced in the eye according to the type of sensitizing antigen employed. When patients are tested with bacterial antigens, the delayed

reaction is usually found, although frequently, especially in patients with acute exudation in the anterior chamber, there may also be an immediate reaction to the soluble bacterial products. It is a plausible hypothesis that such hypersensitivity to the soluble bacterial products may be responsible for the acute edematous reaction. It has already been noted that the initial attacks of nongranulomatous iritis rarely produce much appreciable damage to the eye, but after repeated attacks, damage and tissue destruction often occur. These later organic changes are probably the result of repeated minor insults caused by an antigen-antibody reaction on fixed cells with the bacterial type of hypersensitivity. However, it is an interesting speculation that in patients who also show an associated anaphylactic type of hypersensitivity the final damage done by repeated attacks may in part be a true Arthus phenomenon in the eye; that is, tissue destruction and secondary connective-tissue changes due to interference with the blood supply by thrombosis or rupture of the nutrient vessels.

This concept of nongranulomatous uveitis as a bacterial-hypersensitivity phenomenon obviously suggests desensitization as a therapeutic procedure. Such desensitization should be as specific as possible. In the case of streptococci, there are now some 40 odd antigenically different strains known. The specific strains responsible for the hypersensitive state should be determined, if possible. This is done by individual cutaneous testing with all available strains. Many laboratories, especially those interested in vaccine therapy for rheumatoid arthritis, have a large number, although usually not all, of the known strains on hand, which may be used for the determination of specific sensitivity. After the demonstration of cutaneous hypersensitivity to stock or mixed strains of streptococci, the patient

should be tested against all individual strains obtainable, and the final vaccine should be prepared from the specific strain or strains to which the patient shows the most pronounced sensitivity, rather than from a stock or mixed strain which may, however, be antigenically related.

The route of administration of streptococcus vaccine appears of some importance. It has been shown that the subcutaneous administration of streptococcus vaccine tends to increase and maintain the sensitivity rather than diminish it, while the converse is true when the vaccine is administered intravenously. Wainwright¹¹ has utilized this principle in the treatment of rheumatoid arthritis with streptococcus vaccine, giving the vaccine intravenously. This idea has been followed in the streptococcus vaccine therapy of the recurrent iritis associated with rheumatoid arthritis. The initial dose of the vaccine must be small and cautiously given, otherwise focal reactions will be produced in the eye. The results of such treatment have been gratifying. There are now in records of the Wilmer Institute a number of patients, all with the history of recurrent nongranulomatous iritis associated with rheumatoid arthritis, who have been under intravenous, streptococcus-vaccine therapy for periods up to seven years. The general result is the same—diminishing frequency and then freedom from attacks during the period of treatment. When treatment is stopped, however, recurrences in two to four months are not infrequent. Synchronous with the irido-relapse, there is usually a recurrence of the cutaneous sensitivity which had previously diminished or disappeared under the vaccine therapy. In several of these patients, continued weekly injections of the streptococcus vaccine appear to be the price of freedom from the attacks of iritis.

My only other experience with vaccine therapy for nongranulomatous iritis is

with recurrent gonococcal iritis accompanied with a positive history of infection, a positive complement-fixation test with gonococcal antigens, and a positive skin test to gonococcus vaccine. Here the vaccine has usually been given subcutaneously. The majority of patients so treated appear to be benefited in the sense that the attacks occur at much longer intervals and are much less severe. The results, however, have not been as striking as those obtained with the streptococcus vaccine in iritis associated with rheumatoid arthritis.

Choroiditis. By far the great majority of cases of choroiditis belong to the granulomatous type, characterized by exudation, tissue destruction, and secondary gliosis. While granulomatous disease appears with equal frequency in the anterior and posterior uvea, nongranulomatous disease has an undoubted predilection for the anterior uvea. Why this should be so is not clear. Occasionally, cases of choroiditis are encountered in which the salient symptoms are marked subretinal edema, and an absence of visible exudates and tissue destruction. These cases usually run a short course and are not followed by secondary gliosis. I have seen several such cases which were clearly focal reactions following the diagnostic injection of injudicious amounts of tuberculin. I have not seen such cases in which a bacterial hypersensitivity to other organisms was demonstrated. If such cases occur, they are certainly rare. All that can be said, following the arguments presented for a hypersensitive nongranulomatous iritis, is that such a nongranulomatous choroiditis from bacterial hypersensitivity is a possible clinical entity, and careful observation may establish such a mechanism.

GRANULOMATOUS UVEITIS

Granulomatous disease affects both the

iris and choroid, and often the entire uveal tract. It may, therefore, be discussed as a single entity.

The evidence indicates that in granulomatous uveitis the various recognized, specific etiologic agents are present in living form in the uveal tract. In syphilis, this is certainly true. In tuberculosis, it is likewise almost certainly true. In experimental ocular tuberculosis, practically all the various clinical manifestations can be produced by inoculation of the eyes of properly prepared animals, and living bacilli can usually be demonstrated in such eyes long after all symptoms have disappeared. In the occasional spontaneous uveitis that occurs in animals systemically infected with tuberculosis, the bacilli can be demonstrated in the eye either by bacterial stains or by animal inoculation of the diseased eye. In some forms of clinical ocular tuberculosis, the bacilli can frequently be demonstrated by bacterial stains of sectioned eyes, and the inability sometimes to find them can probably be explained either on technical grounds or on the chronicity of the disease with final healing and consequent destruction of the bacteria. In lymphogranuloma venereum, the living virus is almost undoubtedly present in the ocular lesions, for in the characteristic oculoglandular conjunctivitis that frequently complicates the general infection the virus has been recovered from the conjunctival scrapings. In brucellosis, the bacteriologic evidence at hand indicates that living organisms are probably present in the ocular lesions, although their presence has not yet been conclusively demonstrated beyond shadow of doubt. Nothing can be said of sarcoid, for the specific causative agent, whatever it may be, has never been isolated and the etiology of the disease is a complete mystery. Nothing can be said of other possible etiologic agents until they are identified.

INFLUENCE OF HYPERSENSITIVITY IN GRANULOMATOUS UVEITIS

In syphilis a great deal is known of the influence of specific immunity on the occurrence of syphilitic lesions. The effect of such immunity on syphilitic lesions of the eye has been discussed elsewhere and need not be repeated here. Little or nothing is actually known of the effect of specific hypersensitivity on syphilitic lesions. The reason for this is that no antigen or syphilitic material has ever been discovered with which specific hypersensitivity can be effectively demonstrated. Any hypotheses on the subject are therefore, only by analogy and are little more than idle surmise. In brucellosis, the experimental study of the general disease and of ocular brucellosis, in particular, has not yet been sufficiently extended to warrant any conclusions on the influence of general or local hypersensitivity on the course of the lesions. What evidence there is indicates that both immunity and hypersensitivity may profoundly affect the course of the general and local disease.

There is little or no clinical or experimental knowledge of the effect of hypersensitivity and immunity in the uveitis produced by viruses and fungi. What we do understand, with reasonable clarity and certainty, is the influence of both hypersensitivity and immunity on the lesions caused by the tubercle bacillus. In this regard, both the general lesions of the disease and the lesions of ocular tuberculosis follow the same pattern. We may therefore use tuberculosis as an example to illustrate the effect of hypersensitivity and immunity in granulomatous uveitis.

✓ The instillation of tuberculin in an already tuberculous eye may at times evoke a crop of phlyctenules, and the systemic injection of excessive amounts of tuberculin may likewise cause a focal inflammatory reaction in a tuberculous eye. These are true hypersensitive reactions, they are

dependent on the previous sensitization of the eye by invasion of the eye by the bacilli, and are an example of the delayed reaction produced by the soluble portion of the tubercle bacilli when the eye has been previously sensitized by the protein of the bacterial body. Tuberculous lesions may also be produced by the injection of killed tubercle bacilli, and even by their fractions—tuberculolipides and especially tuberculophosphatide. But these lesions are nonprogressive, even in the nonimmune animal, and their extent is directly proportional to the number of bacilli or the quantity of lipides injected. Such lesions do not concern us clinically. The point to be emphasized is that true progressive tuberculous lesions, with cellular infiltration of lymphocytes and epithelioid cells, tubercle formation, and caseation or encapsulation, are produced only by the actual invasion of the eye with tubercle bacilli and the presence of the bacilli in the eye in living form. The course of the lesions resulting from such bacterial invasion is profoundly modified by the factors of immunity and tissue hypersensitivity, but hypersensitivity to tuberculo-protein *per se* does not produce characteristic tuberculous lesions, notwithstanding the innumerable statements to the contrary with which ophthalmic literature fairly bristles. It is, therefore, incorrect to speak of "allergic tuberculous lesions;" or to say that certain specific ocular lesions (excluding phlyctenules and focal reactions) are "caused by allergy." The lesions are caused by invasion of the ocular tissues by the tubercle bacilli. The course and character of the lesions is modified and influenced by the factors of immunity and tissue hypersensitivity.

In what manner do hypersensitivity and immunity modify and influence the course of tuberculous lesions? This can best be illustrated by following the course of ocular tuberculosis in experimental ani-

mals, for here the picture simulates the clinical disease with amazing faithfulness.

If a normal nontuberculous rabbit is inoculated in the anterior chamber with virulent human tubercle bacilli, there is practically no immediate reaction. With the usual dose of organisms, small hard tubercles develop on the iris, in the cornea, and in the ciliary body in about two weeks. There is only a minimum inflammatory reaction. As the bacilli propagate and the tuberculous lesions multiply, the picture gradually changes. In about four to six weeks after inoculation, the inflammatory reaction increases; evidences of caseation appear with necrosis of the involved cornea and sclera; and somewhere about the 12th week the eyes usually perforate. If sample rabbits from such an experiment are tested from time to time for sensitivity of the eye to tuberculo-protein, it is found that the development of acute inflammation, caseation, and necrosis parallels the development of the hypersensitivity to the tuberculo-protein.

When the eyes of rabbits which have had a previous systemic tuberculosis (immune-allergic animals) are similarly inoculated, the picture is quite different. As a result of the old systemic infection, such rabbits have developed a generalized hypersensitivity of all the body tissues, including the eyes, to tuberculin. At the same time they have developed a greatly increased resistance to reinfection, although there is no relation between the hypersensitivity and the immunity. This resistance to reinfection may be so great that it requires many times the dose given normal rabbits to produce ocular lesions. When the necessary dose of bacilli is injected into the anterior chamber of these rabbits, an acute inflammatory reaction develops in 24 to 48 hours. This reaction lasts for several days. This is the local reaction to the tuberculin in the inoculum and is dependent on the ocular hyper-

sensitivity which has occurred as part of the general sensitization. This reaction subsides within a week, and thereafter there is a latent period of several weeks without symptoms. Hard tubercles then slowly develop in the iris, cornea, and ciliary body. However, these lesions do not increase in size nor progress to the extent they do in the normal rabbit. The inflammatory reaction is usually of low degree, there is very little caseation and necrosis, and these eyes rarely if ever perforate. The entire course of the local disease is restrained, and after three to four months, the process burns out with moderate scarring and damage to the eye. If the eyes of sample rabbits from a series of such animals are examined for local reactivity to tuberculo-protein, it will be found that there is only a very moderate increase in the local reactivity and the degree of inflammatory reaction and tissue destruction in the eyes parallels the degree of local hypersensitivity.

This fundamental principle, that inflammation, caseation, and necrosis parallel the degree of local-tissue reactivity to tuberculo-protein, can be illustrated in various other experiments. For example, rabbits develop varying degrees of hypersensitivity to tuberculo-protein after systemic infection. Thus when the eyes of animals with a low sensitivity are inoculated with tubercle bacilli only minimal inflammatory lesions result; while if the eyes of animals with high sensitivity are selected, much more pronounced inflammatory symptoms result. Similarly, if hypersensitive rabbits are desensitized with tuberculin prior to inoculation of the eyes, there is almost no inflammatory reaction to the tuberculin in the inoculum, and any later inflammation or caseation is proportional to the degree of local hypersensitivity which the eyes later again develop as a result of the local infection.

Just as different rabbits develop differ-

ent degrees of tissue hypersensitivity after systemic infection, they likewise develop different degrees of immunity. When a series of rabbits with systemic tuberculosis is inoculated in the eyes, some develop no symptoms whatsoever, while others develop ocular lesions after widely varying inoculation periods. Some require huge doses of bacilli to evoke ocular lesions, while others develop lesions after a relatively small dose of bacilli. In rabbits with low immunity, the tuberculous lesions usually spread throughout the eye, and with the spread of the lesions increased local hypersensitivity develops. As a consequence, there is an increased inflammatory reaction with greater tendency to caseation and necrosis. In rabbits with high immunity, the lesions are much smaller, show little tendency to spread, run a shorter course, and heal comparatively quickly.

Thus by studying large numbers of systemically infected rabbits which have later been inoculated in the eye, the factors that modify the course and character of ocular lesions become apparent. If the immunity is high and the tissue hypersensitivity is low, minimal lesions result, with little inflammatory reaction, and such lesions usually become quickly encapsulated. On the other hand if the immunity is low and the tissue hypersensitivity is high, spreading inflammatory lesions result, with caseation and necrosis. Various fluctuations between these two extremes produce the intermediate chronic type of reaction.

I have spoken of "local" tissue hypersensitivity, meaning the hypersensitivity of the tissues of the eye and not the general cutaneous or systemic hypersensitivity. In experimental animals, the local ocular sensitivity can be readily determined by injecting measured amounts of tuberculin or purified protein derivative into the eye, estimating the ensuing in-

flammatory reaction, then enucleating the eye and evaluating the histologic reaction. Unfortunately in patients, there is no safe way of estimating this ocular sensitivity. From experimental studies, it has been clearly demonstrated that in a tuberculous eye, there may be no parallelism between the local ocular reactivity to tuberculin and the cutaneous reactivity. The local disease in the eye may produce a high degree of local ocular reactivity, while the cutaneous sensitivity remains low. The tuberculous process in the scleral envelope is insufficient to affect profoundly the cutaneous sensitivity. However, if the cutaneous sensitivity is high, the ocular sensitivity is likewise high, for the eye participates in the general tissue reaction.

In the study of clinical ocular tuberculosis, we are handicapped by this inability to determine the degree of local ocular hypersensitivity. All that can be determined is the degree of cutaneous sensitivity. If this is high, then the ocular sensitivity can safely be assumed to be high. But if the cutaneous sensitivity is low, the ocular sensitivity may be much higher, influenced by the local disease. The degree of ocular sensitivity in such cases can be estimated only by studying the degree of inflammatory reaction, and searching for evidences of caseation and necrosis, which are the concomitants of local tissue sensitivity. Yet, despite this handicap, when cases of clinical ocular tuberculosis are studied over a period of years, they appear to follow the same general pattern of experimental lesions.

Thus in infants and children, ocular tuberculosis is characterized usually by a high degree of hypersensitivity and a low immunity. A tuberculous choroiditis in a child or in the Negro (in whom the tuberculous process generally is of the infantile type) usually spreads rapidly and tends to involve the entire fundus with extensive caseation and tissue destruction.

Tuberculosis of the anterior uvea usually is of the same severe type. In children with a miliary tuberculosis, tubercles on the iris and choroid are not uncommon. These children may be so ill that they are unable to develop any tissue response to the invading bacilli, and there may be little inflammatory reaction around the tubercles. But if these children are hypersensitive or if they do not die from the generalized infection and bacillemia, and later develop hypersensitivity, then the iris tubercles undergo an inflammatory reaction, increase in size, coalesce, and there is caseation, tissue necrosis, and often actual perforation of the eye.

In young adults or older patients in whom a general systemic immunity of varying degree has developed but in whom tissue hypersensitivity may still be high, tuberculous lesions such as sclero-keratitis run a typical course of attacks of acute inflammation, but tend to be walled-off, self-limited, only to recur again and again as the resistance fluctuates. Tuberculous periphlebitis with the recurrent vitreous hemorrhages is usually a disease of early adolescent life and is usually accompanied by a high degree of sensitivity to tuberculin.

What histologic evidence there is indicates that the so-called "circumscribed plastic choroiditis" is a localized tuberculous lesion. It occurs usually in adults and is characterized by single exudates near the posterior pole of the eye which quickly become circumscribed and walled-off. In such patients the cutaneous sensitivity to tuberculin is usually moderate or low. The course of the choroidal lesion, with an absence of surrounding inflammatory reaction, with rapid walling-off and gliosis, suggests the local tissue sensitivity is also low, while the immunity of the patient is high. In short, in individuals with high sensitivity and low immunity, the lesions of ocular tuberculosis are

characterized by high inflammation, invasive tendency, and tissue destruction; while in individuals with low sensitivity and a well-developed immunity, the lesions tend to be minimal, are attended with little inflammatory reaction, and are rapidly encapsulated. The long drawn-out, chronic, fluctuating lesions are indicative of both moderate resistance and hypersensitivity.

If we grasp the underlying principles which determine the character and course of tuberculous lesions of the eye, the therapeutic indications are clear. They are: (1) to enhance the resistance of the patient to the disease; and (2) to abolish the tissue hypersensitivity. Unfortunately, there is no direct way to increase the immunity, for artificial immunization is still much of a sought-for dream. General hygienic measures are still our main resource. Desensitization with tuberculin is a long and laborious process, often difficult and sometimes impossible to accomplish, and when once accomplished can usually be maintained only by continued tuberculin treatment over years. Yet unsatisfactory as these procedures may be, they are still the cornerstones of the treatment of ocular tuberculosis.

CONCLUSIONS

I have endeavored to point out the clinical differences between two types of uveal disease, nongranulomatous and granulomatous. Both types are dependent on invasion of the eye, at one time or another, by living bacteria, but the pathogenesis and character of the lesions in these two types of uveal-disease, appear to be quite different. In the nongranulomatous type, the primary invasion of the eye is probably by organisms either of low virulence or in small numbers. The result is that they are destroyed by the normal bacteriocidal action of the ocular fluids. This primary invasion produces either in-

significant lesions or no lesions at all, but it does produce a local hypersensitivity of the ocular tissues either to the bacterial protein or to the soluble bacterial products. This hypersensitivity may be of the bacterial type, or of both the anaphylactic and bacterial type. When the bacterial antigens again reach the eye, either through reinfection or absorption from an infected focus or even a normal cutaneous or mucous-membrane surface, there results a hypersensitive reaction in the eye. This reaction is produced either by organisms which do not proliferate, or by their bacterial products. In either event, the reaction is essentially an evanescent one and is characterized by an intense vascular congestion and a minimum of tissue damage—the picture of a nongranulomatous uveitis.

In the granulomatous type of uveitis, the mechanism is quite different. The organisms reaching the eye are not destroyed, but remain viable in the ocular tissues, and by their presence, proliferation, and inherent toxicity, produce local lesions in the eye. The character of the resulting lesion is profoundly modified and influenced by the factors of local hypersensitivity and general immunity. The proliferation of the organisms in the eye produces a local hypersensitivity to the bacterial products. This hypersensitivity is of the bacterial type, and a reaction between the hypersensitive tissue and the bacterial products may thereafter result. If the proliferation of the bacteria is not restrained by the forces of immunity, this hypersensitive reaction will be progressive, characterized by inflammation, caseation, necrosis, tissue destruction, and often a compensatory overgrowth of granulomatous tissue. If however, there is present either a natural or an acquired resistance to the infection, the proliferation of the bacteria is restrained and the reaction is minimal.

I have used tuberculosis as an example to illustrate the influence of hypersensitivity and immunity in granulomatous uveitis. I realize fully that there are many peculiarities of the tubercle bacillus which differentiate it sharply from nonacid-fast pathogenic organisms and open the door for the criticism that the general laws which influence tuberculous lesions may not be applicable to disease caused by other bacteria. Yet, I do not believe this to be true. I believe the same general principles of resistance to infection and tissue hypersensitivity, which have been so extensively studied in tuberculosis, will likewise apply, with minor variations, to the lesions found in other infectious granulomatous diseases. This can be de-

termined only through further animal experimentation and clinical observation. Our knowledge of resistance and hypersensitivity and their influence on local and systemic disease has broadened greatly in the last few decades, but there is still much to be learned. If we approach the problem of the etiology of uveitis with an orderly concept of the underlying principles of infection, resistance, and hypersensitivity, as they are now known and may later be amplified, I believe the influences of these fundamental tissue reactions will be demonstrated, not only for the present known causes of uveal disease, but also for other etiologic factors which yet remain to be discovered.

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A CONTRIBUTION TO THE KNOWLEDGE OF OCULAR SIDEROSIS AND POSTERIOR DEGENERATIVE PANNUS*

PART I OF THE RESEARCH IN INDUSTRIAL OPHTHALMOLOGY

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It has been generally accepted, since Leber published his classical investigations, that an intraocular iron splinter is partly converted by the carbonic acid of ocular fluids into one or more diffusible compounds.

When the experiment is carried out on rabbits' eyes, the compound, bicarbonate of-suboxide of iron, is precipitated (possibly by oxygen in the tissues) both near the foreign body (direct siderosis), and also at a distance (indirect siderosis).

Even the best microscopic reagent at our disposal (Perls's hydrochloric acid and potassium ferrocyanide) does not reveal all the iron present, as a further portion combined with protein is not stained as Prussian blue.

Examination of a siderotic retina, stained in bulk by Perls's method, reveals not only beautiful blue patches, but a rash of brown patches which may contain masked iron, melanin, or both.

Certain tissues of the eye may have a selective affinity for different chemical compounds. Elastic fibers, for instance, are argyrophil, as Loewenstein (1941) has shown in the tissue of the argyrotic tear sac; copper, too, is localized to certain tissues of the globe in chalcosis bulbi; while Wolff (1934) has suggested that all living cells will absorb iron in varying degrees, glass membranes being the least absorptive of all.

The literature on siderosis is already extensive, and we only feel justified in

publishing our case in detail, because we have observed tissue changes which lead to general conclusions. The discovery of some of these changes is due to the employment of methods frequently neglected by the majority of investigators.

The patient, a fitter aged 40 years, who had never worked as a smith or been unduly exposed by his occupation to infra-red radiation, was first seen in 1935. He was then applying for a Civil Service post, and stated that his left eye had been blinded by an intraocular steel splinter which was "removed by operation" shortly after the accident in 1923. The eye showed no visible perforating scar, but had characteristic rusty changes in the iris, and brownish spots at the anterior surface of the cataractous lens. The vision amounted to good projection of light only.

The patient was told that excision might eventually be necessary, but that this would not be essential so long as the eye was free from inflammation. The eye remained quiet until 1944, when he had attacks of pain lasting a week at a time.

He finally came for treatment in September, 1945, with a severe iritis and hypopyon, which had lasted three weeks. The eye was then acutely inflamed and blind. The cornea was edematous, the anterior chamber contained a hypopyon and a supernatant brownish fluid. The iris, a deeper brown than before, was tremulous—the cataract having disappeared from the pupil.

The right eye had at all times been completely normal. After excision under local anesthesia, the siderotic eye was fixed in formalin.

* From the Tennent Institute, Glasgow, Prof. W. J. B. Riddell, Director. Sponsored by the W. H. Ross Foundation (Scotland) for the study and prevention of blindness.

Frontal division of the eye revealed an opaque and shrunken lens floating freely in a fluid vitreous. A metallic foreign body was firmly embedded (6 mm. from the limbus) as is shown in the natural size

the site of water-clear cysts, whose elevation was clearly demonstrated by the narrow beam.

Many pieces of the peripheral retina and choroid were excised for examina-

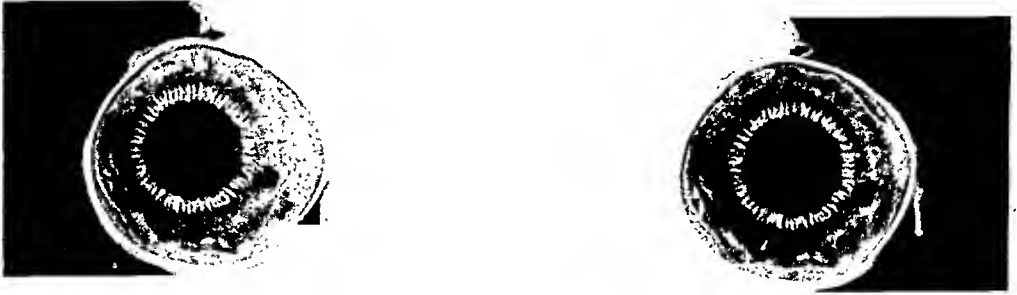


Fig. 1 (Loewenstein and Foster). Stereophotograph of the foreign body in situ. Anterior half of the eye.

stereophoto (fig. 1). The visible portion measured $0.75 \times 2.5 \times 2$ mm. The foreign body was removed without difficulty prior to embedding the eye in celloidin. An oval defect of the iris tissue was revealed by diaphanoscopy, marking the track of the foreign body into the interior of the globe.

Slitlamp examination of the posterior half of the opened eye showed thin retinal vessels and that the macular area was

tion in bulk, while the horizontal area, about 8 mm. broad, containing the disc and macula, was embedded in celloidin.

The corneal epithelium was abraded at many points (artefact), and Bowman's membrane was marked by dark round corpuscles in the hematoxylin and eosin slides. In the periphery these were isodiametric about 0.25 to 0.5μ . Toward the center the granules were thicker about 1μ in diameter, and occurred more frequently (fig. 2). A few granules were found in the superior corneal lamellas. Toward the epithelium the granules were generally denser than they were basally (fig. 2).

Perls's Prussian-blue reaction showed a fine blue haze in the epithelium and that these corpuscles were ferric. Their size was the same in sections stained by hematoxylin, Perls's method, or by the two methods combined.

The corneal corpuscles were clearly visible and neither shrunken nor edematous. The corneal



Fig. 2 (Loewenstein and Foster). Siderosis of Bowman's membrane.

corpuscles, Descemet's membrane, and the endothelium were iron free and normal, if one excepts a few macrophages and neutrophil leukocytes adhering to the endothelium.

The hypopyon contained plasma cells in addition to macrophages, neutrophil leukocytes, and pigment, both free and in macrophages. A moderate number of eosinophils were present (fig. 3). While the macrophages contained both Prussian-blue particles and a brownish-yellow pigment, the reticulum cells around Schlemm's canal contained a modest amount of blue particles only.

Some of the limbus vessels were "cuffed." The trabeculum contained a scattered mass of red blood corpuscles, which stained well with eosin.

There was an intensive patchy infiltra-

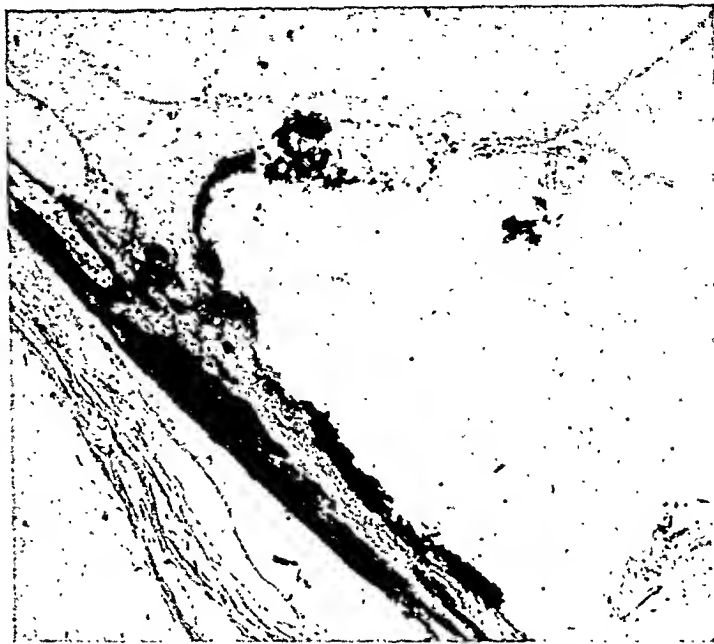


Fig. 4 (Loewenstein and Foster). Section through the pars plana and of the ciliary body near the site of the foreign body. This shows primary siderosis and deep-blue plaques in the thickened retina with Perl's reaction.

tion of the iris tissue, and the vessels were dilated and engorged. The infiltration consisted almost entirely of plasma cells, although some macrophages with a coarsely granular protoplasm were found superficially.

In the ironstained slides, a large amount of blue granular tissue could be found between the pigmented layer and the clearly visible dilator fibers, infiltrating the latter. Some of the latter showed iron granules as well.

The ciliary body showed far less inflammatory cellular infiltration. With Perl's reaction, there were many fibroblasts filled with blue granules. There were polygonal reticulum cells in the corpus ciliare containing even larger granules. A considerable amount of iron was free in this area, and large poly-



Fig. 3 (Loewenstein and Foster). Tough hypopyon with cellular infiltration of the iris and ciliary body.

hedric cells like mast cells were crammed with dark-blue masses. Both the pigmented and unpigmented epithelial layers showed patches of iron at certain places, and a fine blue powder at others. The ciliary body contained a multitude of

foreign-body giant cells were found. Here were iron-laden fibroblasts, neutrophil leukocytes, and macrophages, some of which had engulfed iron material.

At the side where the foreign body was situated, no trace of zonular fibers could

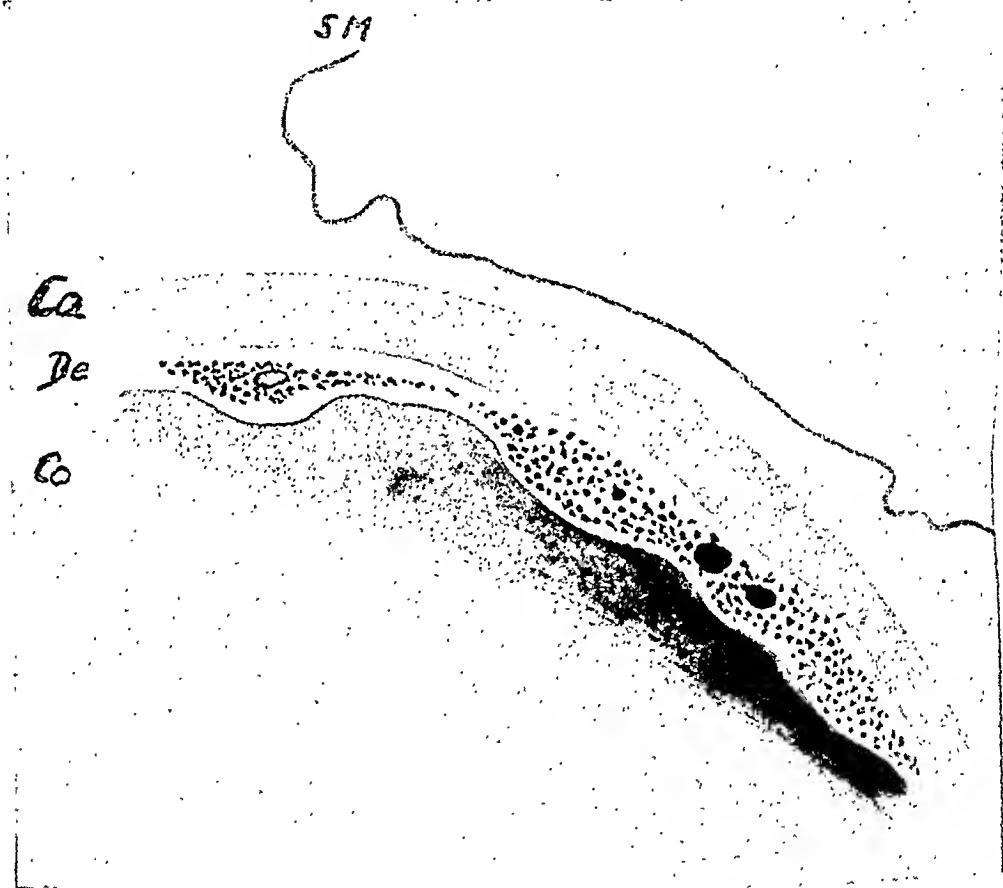


Fig. 5 (Loewenstein and Foster). Lens capsule, Perl's reaction (oil immersion). The capsule is iron free, as is also the split-off lamella. The subcapsular epithelium contains a fair amount of iron granules. The nuclei stained a very dark blue. SM, split membrane. Ca, capsule. De, degenerated epithelium. Co, corticalis.

ragged blue patches. Some swollen cells with round nuclei on the posterior iris surface contained dark, round inclusions.

At the site of the foreign body the scleral fibers were irregular, and broken up plaques—Fe+Ca—were present (fig. 4). These were probably broken in the removal of the foreign body prior to the embedding. Between these layers an eosin-red, hyaline mass was present, extending into the vitreous space. No for-

be found; while at the opposite side, some broken-up, glassy, preretinal fibers were visible in a position suggesting that they corresponded to zonular fibers. The space between these glassy fibers was filled with small, thin cells and with macrophages containing small brown and (iron) blue bodies.

The freely movable, shrunken, and markedly deformed lens was embedded separately in paraffin, and sectioned me-

tionally. The subcapsular epithelial nuclei were irregularly distributed and broken up (fig. 5). A lens capsule of variable thickness covered the entire lens and was split most markedly where it was the thickest, presumably the anterior pole (figs. 6a and 6b). There were brownish granular masses between the capsule and the irregular flat nuclei of the epithelium. A layer of subepithelial tissue less than 8μ thick stained eosin red, but the remainder of the lens matter was a loose purple-stained granular mass.

The lens capsule showed under high-power magnification ($\times 1,350$) an anterior lamella of a purplish-pink color (fig. 6a) which could be seen overlying another lamella of equal thickness but unstained. The split membrane (fig. 6c) was continuous with the more anterior of these layers. Where this membrane floated in front of the lens, this unstained lamella was absent from the lens itself.

The choroidal vessels were broader than usual, but there was no sign of posterior-choroidal infiltration except toward the periphery, where the choroid consisted of pigmented scar tissue fused with the retina. There were some groups of plasma cells and thickening of the pigment of the suprachoroid. The hexagonal cells were paler than normal, and the pigment, which was scattered in the central area, was aggregated toward the periphery. There was no visible break in Bruch's membrane which was very thick near the disc. The opacity of this thick area suggested the fatty degeneration frequently found in degenerated eyes.

The wavy appearance of the thickened, inner-limiting membrane near the macular area was not just a postmortem appearance, as the crests of the waves were linked by membranes consisting of fibroblasts, lymphocytes, and macrophages (fig. 7). The valleys between these crests

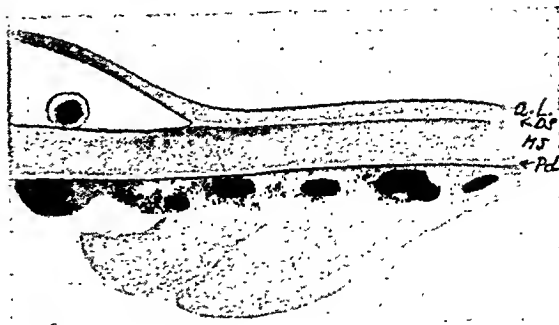


Fig. 6a (Loewenstein and Foster). Siderosis of the lens capsule ($\times 1,350$). One fifth of the capsular thickness is split off. There are clearer spaces; one beneath the split lamella and a similar one at the posterior delineation. These clearer lamellas can be followed over considerable distances. A.L., anterior lamella. DS, delineation space. MS, Main substance. Pd, posterior delineation space.



Fig. 6b (Loewenstein and Foster). The lens capsule split over a large area. The split lamella is cut partly flat. (H.E. $\times 300$).

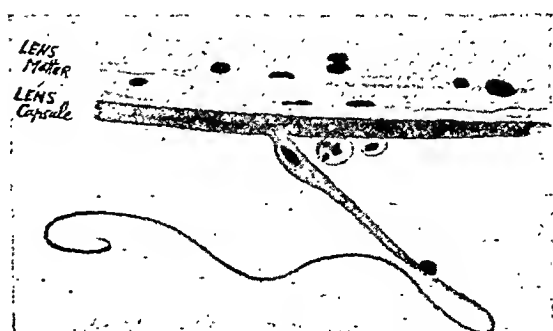


Fig. 6c (Loewenstein and Foster). Split lens capsule.

were filled by neutrophil leukocytes, red blood corpuscles, and ghost cells. The same cells were visible in front of the

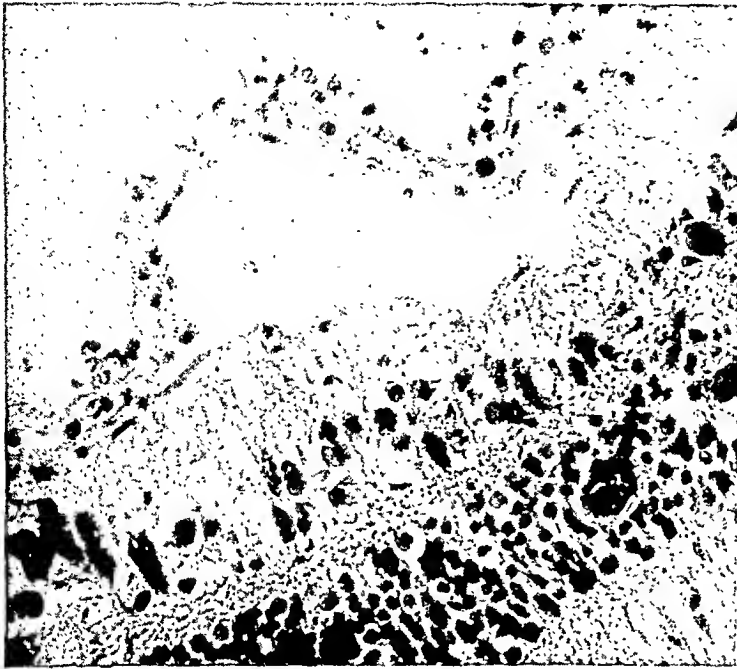


Fig. 7 (Loewenstein and Foster). Preretinal bands covered with lymphocytes and macrophages. Note the swollen ganglion cells.

membranes. The retina contained pigment clumps everywhere in the periphery.

The macular area was full of exudates (fig. 8). These were marked in the internuclear layer and pressed the fibers of Henle's layer apart. These fibers were very curved, and there were often only a few present between the eosin-red exudates (fig. 9).

The staining of the exudates was un-

the order of the layers. Contraction of the deep exudates had even led to a folding of the posterior retinal surface.

The ganglion cells at the macula were particularly noteworthy, being sparse and of great size (fig. 10). The nuclei resembled those of the internal nuclear layers in size, but the protoplasm was three or four times as large as normal, stained with eosin and foamlike (fig. 10).

Slightly to the temporal side of the macula, the retina showed very few intact ganglion cells. The thickened eosin-red Mueller's fibers stood out sharply. In the outer molecular layer nearer the periphery, the layers became irregular. Glial fibers often accompanied by pigment cells traversed the whole retinal thickness in an oblique fashion. Midway between the disc and the ciliary body, heavy sub- and

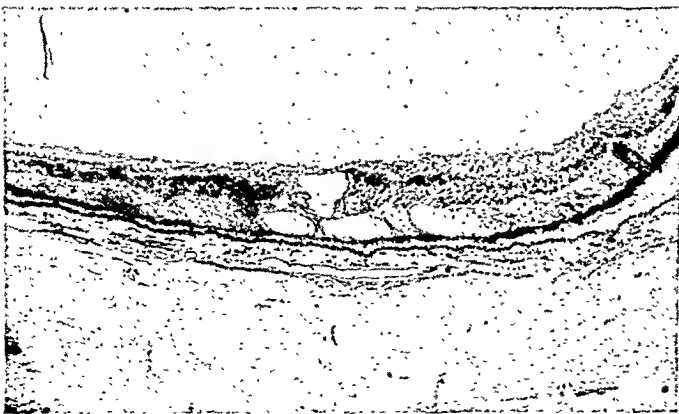


Fig. 8 (Loewenstein and Foster). Cystic macular degeneration.

intraretinal patches of pigment occupied the destroyed retina. A thick layer of pigmented masses and a criss-cross of glial fibers were left. The retina and choroid became fused long before the ora serrata was reached. The neuro-epithelium was absent for the most part, as in pigmentary retinal degeneration.

A flat plaque of nerve fibers and glial nuclei filled the concavity of the curved cribriform plate. Immediately behind the lamina cribrosa was an area of cavernous degeneration, absent from the posterior part of the optic nerve.

The endothelium of the arachnoid was markedly thickened, and the arachnoidal space was increased in size. A perfect corpus arenaeum powdered with lime was visible. This contained no iron.

Iron staining showed that there was no iron in the optic nerve and very little in the posterior part of the retina. Iron corpuscles were found nearer to the disc at the nasal side than at the temporal. The cystic area was practically iron free. While there were free, small, round iron corpuscles, the majority formed dark-blue intracellular patches. These exudates and the huge edematous ganglion cells were iron free.

The more peripheral the retina, the more degenerate it was, and the denser were the dark-blue patches. In addition, there were many light-blue lines and very fine granules (probably adsorption phenomena) at the surface of the individual cells.

The surface of the unstained exudates in the periphery (smaller than those in the macular area) showed a definite blue line.



Fig. 9 (Loewenstein and Foster). Cystic macular degeneration. Eosin-red exudate in the outer molecular layer with fatty corpuscular cells. Müller's fibers bend outward.

Except for isolated choroidal chromatophores and single hexagonal cells, there was little iron staining in the choroidal sections.

Even where the retina and choroid were indistinguishably fused, the blue retina showed diffuse siderotic changes; while in the pigmented choroid, single blue patches and single iron-filled cells of the chromatophore type only were visible.

RETINA AND CHOROID IN BULK

One's first impression on examining the inner side of the unstained retina in bulk was that of a dense fibrous tissue in

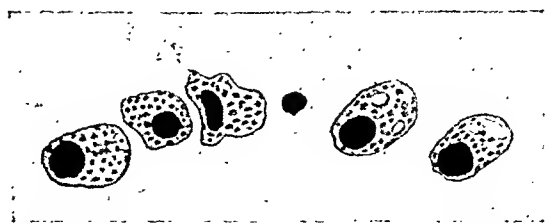


Fig. 10 (Loewenstein and Foster). Siderotic ganglion cells of the retina. Note vacuolation.

which both fine and coarse brownish-yellow pigment patches were visible. Heavy brown and black patches were isolated by fibrous tissue running concentrically round them (fig. 11). These pipelike spaces could be observed through the entire thickness of the retina. The most striking view was obtained by examination of the retina in bulk from the outer

mained at the level of the outer retinal surface and its conglomerate hexagonal cells. Cross sections through peripheral retinal tissue showed these empty endothelial structures at the posterior retinal surface. A granular exudate in front of Bruch's membrane contained eosinophilic granules (fig. 13). It was vascularized and disintegrating, and corresponded to

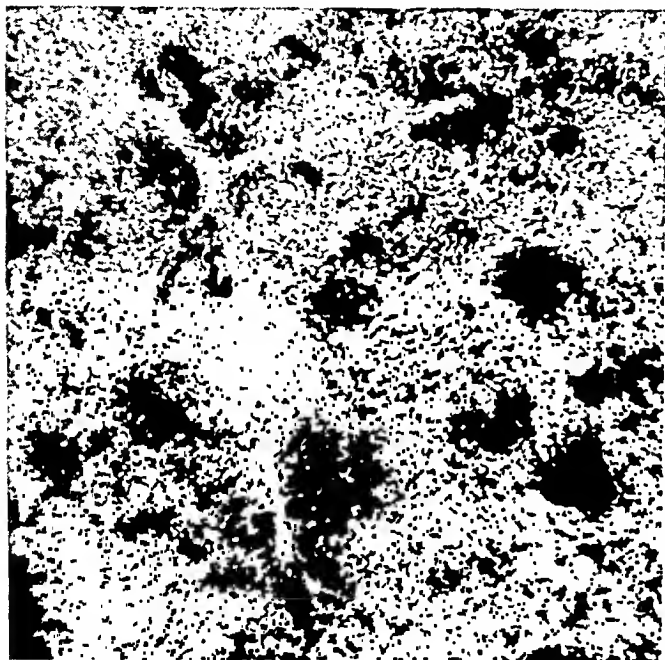


Fig. 11 (Loewenstein and Foster). Retina in bulk. Unstained. Examined from the choroidal aspect. Note the dark, brownish retinal patches in all layers and the bands surrounded by pigment. The majority of the pigment patches are dome-shaped and are situated in empty spaces. The unstained bands may be identical with the fatty vascular network (posterior pannus, stained red with Sudan 3).

surface. Irregular, broad, stripelike bands divided the patchy, pigmented area. In the retina in bulk, stained with scarlet red, brownish patches outlined the course of these vessels which formed a regular network of shiny red bands. These were approximately equal in breadth, the largest being 45 to 50 μ m. wide (fig. 12a).

High-power magnification showed the bands to be lined with darker red patches parallel to their course. This network was located 50 μ m. below the retinal surface and was limited to the retinal periphery only. There was no evidence in any part of the network of a lumen or blood corpuscles. The distribution, particularly the branching, was reminiscent of a vascular system.

The major portion of this network re-

a posterior pannus. There was a certain similarity to the process of disciform macular degeneration in which capillaries from the choriocapillaris migrate through a break in Bruch's membrane.

The entire peripheral retinal tissue was a bright Prussian blue in which there were dark-blue patches corresponding to the dark-brown ones visible in the unstained retina in bulk (fig. 14). These blue patches were insulated by concentric glial bands. Many of the dark-blue patches contained a quantity of brownish elements (fig. 14) in which the iron molecule might be masked by a protein compound.

Similar structures could be found stained scarlet red in the choroid in bulk (fig. 15). Situated at the level of the hexagonal cells, they overlaid the regular ar-

rangement of the larger choroidal vessels. At some points their regular width was interrupted by an isthmuslike narrowing. The plane of these structures was about

fat granules; in others the processes were outlined by shining red fatty droplets.

When the choroid was stained for iron in bulk, the majority of the hexagonal

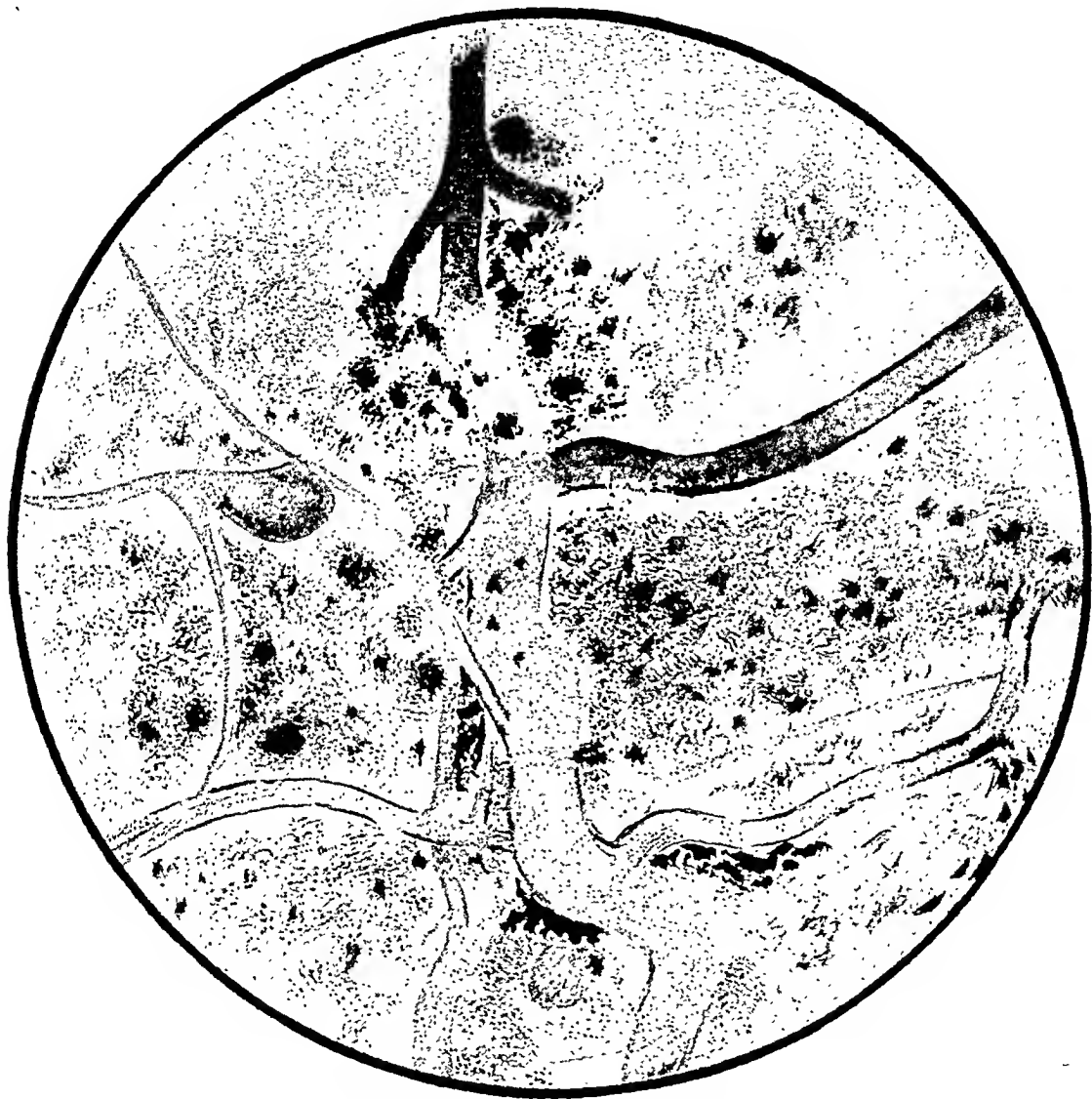


Fig. 12a (Loewenstein and Foster). Siderosis. Retina in bulk stained with scarlet red and examined from the outer surface ($\times 60$). The fatty vascular network, stained shining red with scarlet red is partly covered by degenerate hexagonal cells. The fatty cells and irregular branching of the vessels should be noted. The pigment of the hexagonal cells is partly brown and partly black, like Chinese ink.

30 to 35 μ beneath the chromatophore network in the suprachoroid. Here and there, however, conglomerations of hexagonal cells obscured the red network.

Many suprachoroidal chromatophores were filled with a mixture of pigment and

cells, whether intact or damaged, were iron-free. In the periphery, however, there were hexagonal cells, isolated or in groups, which contained iron granules. Some choroidal reticulum cells were filled with blue corpuscles.

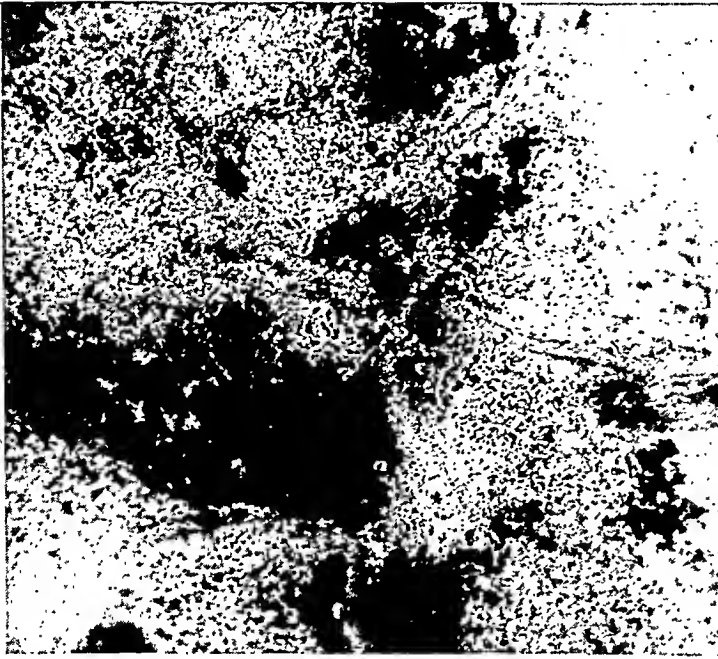


Fig. 12b (Loewenstein and Foster). Retinal periphery ($\times 300$ H.E.). This section includes bands which may correspond to the fat-stained filaments in the retina in bulk. The red bands do not show up so well as in Figure 12a which was drawn through the microscope.

DISCUSSION

The symmetrical and equal distribution of the iron-containing corpuscles over the whole of Bowman's membrane, in spite of the lateral position of the foreign body, suggested that the distribution must have been via the blood and lymph streams and not by direct diffusion from the foreign body.

It was possible that the location of the

spherical bodies within Bowman's membrane was the expression of a reduced metabolism in the injured eye, similar to that associated with band-shaped corneal degeneration (Loewenstein, 1946).

Since the hypopyon contained only a moderate number of polymorphs and many macrophages and plasma cells, it was a chronic condition. Clinically such an hypopyon might be expected to be

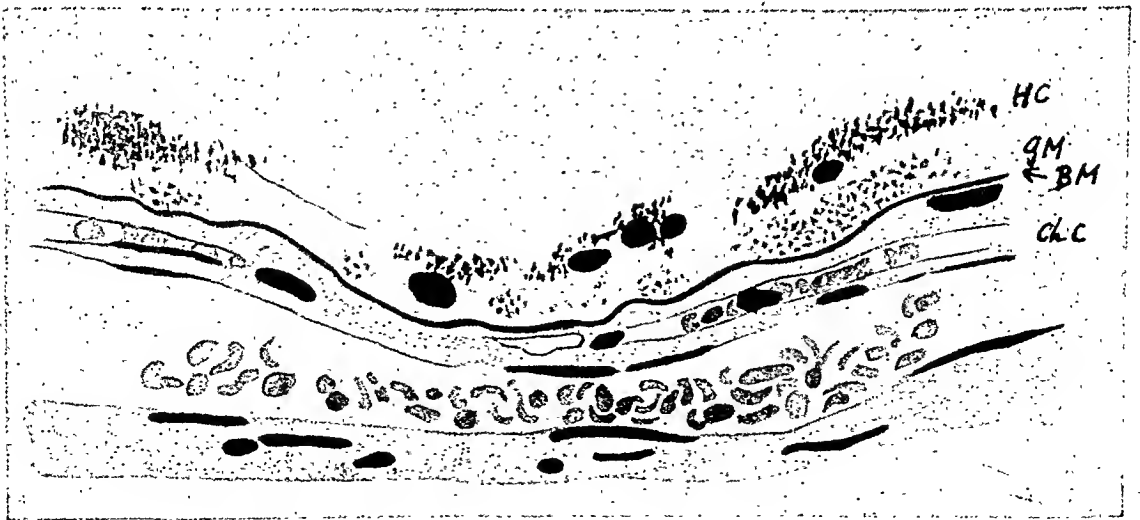
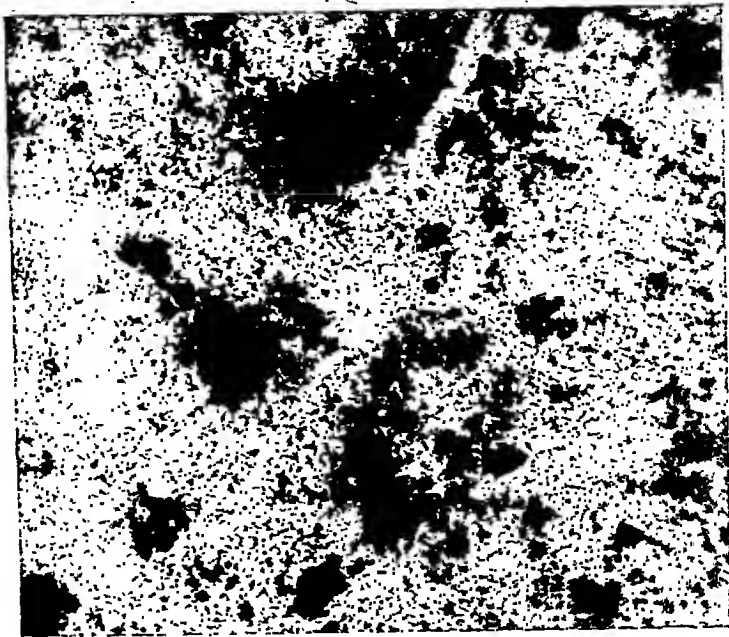


Fig. 13 (Loewenstein and Foster). Granular mass located between Bruch's membrane and hexagonal cells may originate from the posterior pannus. (H.E. oil immersion). HC, hexagonal cells. GM, granular mass. BM, Bruch's membrane. ChC, choriocapillaris.

Fig. 14 (Loewenstein and Foster). Retina in bulk stained for iron by Pärks's method. The dark patches are blue with many brownish foci. The lines correspond to the fatty network of the posterior pannus.



tough and firm. Its macroscopic appearance did, in fact, bear this out.

The scattered red corpuscles in the pectinate ligament were an unusual finding, as they showed no further signs of disintegration. Certainly there was nothing here reminiscent of the blockage of the ligamentum pectinatum which led to glaucoma in Erdmann's well-known experiments with electrolytic iron in the rabbit.

If the generally accepted view that iron is dissolved in the aqueous is correct, then it was extraordinary that the endothelium and Descemet's membrane should remain iron-free, although bathed for years in this solution. It is also difficult to explain why, when Descemet's membrane remained free from iron, Bowman's membrane should store it. *A priori*, one would expect the contrary.

It is possible that the calcium granules in Bowman's membrane were the sequel of chronic uveitis and that this might provide a nidus for the absorption of iron.

The plasmocellular iris infiltration was obviously a chronic change and, as suggested frequently in earlier papers, was reminiscent of an infectious granuloma (syphilis, for instance). The iris infiltra-

tion was unrelated to the site of the foreign body, as the plasma-cell infiltration, although patchy, was equally distributed.

The large mononuclear cells in the vitreous resembled those found in sympathetic ophthalmia. Since the majority of them were iron-free, they may have been an expression of longstanding irritation only.

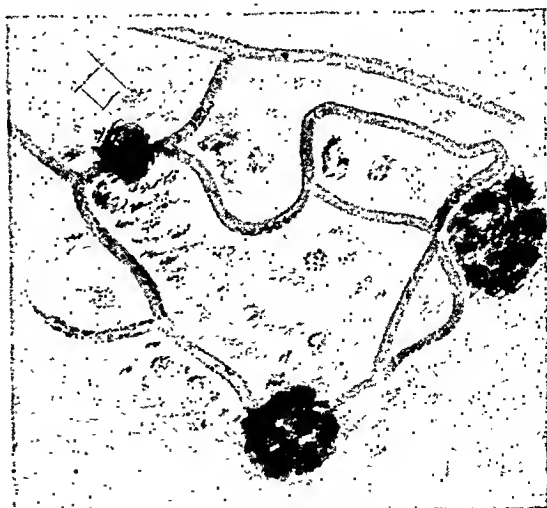


Fig. 15 (Loewenstein and Foster). Choroid in bulk stained by scarlet red. Examined from retinal aspect ($\times 150$). The network of red-dish bands is about 8 to 12 μ broad.

In our case, there were wide areas over which the lens capsule had split off. This split glassy membrane was either loose or, where attached, arose at a sharp angle from the lens capsule. This splitting was in no sense radiational, as in fireworkers cataract, and was probably due to the toxic process. It is possible, in its etiology, it could be compared to senile exfoliation of the lens capsule, a condition whose pathology has not yet been completely investigated, and which may also be due both to failure of the intraocular metabolism and to toxic products.

The split was too extensive and the lamella too thick to be identified with Berger's zonular lamella. It is not impossible that there may be an unrecorded stratification in both the anterior and posterior capsules of the lens which would provide an anatomic basis for the breakaway of the anterior lamella, both in this case and in cases of fireworkers cataract.

The center of the shrunken lens contained a dark-purple mass, which might have been calcium phosphate, as hydrochloric acid dissolves it but does not evolve any bubbles.

The optic nerve and the posterior part of the retina and choroid were practically iron-free. The entire retinal periphery, not merely the peripheral retina around the foreign body, contained absorbed iron particles. The change was, therefore, independent of the site of the foreign body.

It is significant that there was no evidence of iron in the cystically degenerated macular area. We must conclude, therefore, that the macular disease was an indirect sequel of the intraocular foreign body and might have been due to the cyclitis present.

The swelling and degeneration of the macular ganglion cells was secondary, as was the overall reduction of the number of ganglion cells in the area where no iron was detectable.

The destruction of the peripheral retina would appear to have been a direct toxic effect; the damage to the choroid secondary.

The exaggeration of the glial lattice could be explained as an attempt at a kind of scar production, as in atrophies of nervous tissue. Glial growth predominated, as in retinitis pigmentosa, and was associated with pigmentary changes due to the migration of hexagonal cells along the glial bands into the shrunken retina. Most of the pigment was found in the deeper layers.

Another interesting feature was the band system found on the outer retinal surface. If these structures were of vascular origin, they might have originated in the choriocapillaris and broken through the lamina of Bruch. No histologic proof of this assumption was available.

Although reminiscent of vessels in some ways, there was, on the other hand, no evidence whatever of lumen in their bandlike cross section, nor did vessels exist either at this depth or in this peripheral part of the retina.

Since a great many hexagonal cells were destroyed, this layer adhered in part to the retina and in part to the choroid, as has been described. Our final assumption was that this band system was a posterior pannus. The positive scarlet reaction manifested a fatty degeneration of the wall in the whole system.

Vascularization between Bruch's membrane and the hexagonal layer in disciform macular degeneration has been recorded by Verhoeff and Grossman (1937) and Terry (1938). According to Reichling (1937, 1938) this condition may also occur in normal senile eyes. Loewenstein's investigations have confirmed both findings.

It is clear that during the 22 years the metallic splinter was imbedded in the eye,

parts of the iron foreign body were dissolved by the intraocular fluid, and certain of the eye tissues were saturated with iron. According to d'Amico (1925) the iron and tissue proteins combine and coagulate in an irreversible chemical reaction. We can, therefore, assume that any tissue found at biopsy to be free of iron has never in fact contained it. There are many reasons for believing that the vehicle of the iron transfer is the intraocular fluid and this reasoning is in fact generally accepted by all investigators.

The localization of iron in tissues by chemical methods enables us to use it as a "tracer" substance and a guide to ocular metabolism. For instance, the freedom of Descemet's membrane and the corneal lamellas from iron salts leads us to conclude that the endothelium was alive and impermeable to the ionized iron in the aqueous.

Further, if it is conceded that the vitreous contains iron salts from secondary siderosis, their absence from the macular area and optic nerve is surprising. From our observations, we might deduce that currents in the vitreous are equatorial and not in the antero-posterior direction, the metabolism of the posterior pole being a function of the choroid, slightly assisted by the retinal vascular system.

The usual reaction of the iris to iron is of a chronic granulomatous type, but evidence that acute, purulent inflammation (polymorphs) also occurred after 20 years of the presence of the foreign body is noteworthy.

Imbibition by the zonular fibers destroys their contractility; they elongate and finally rupture. The specific gravity of the lens then causes it to sink downward. The capsulo-epithelium degenerates, and the lens capsule splits as in the exfoliation of fireworkers cataract. The lens fibers degenerate and calcify.

The macular area degenerates cystically

(Haab, 1888). Fatty corpuscular cells are frequent around the eosin-red exudates in the outer molecular layers. It is our belief that these iron-free changes at the posterior pole of the eye were an indirect sequela of siderosis and were due to a chronic cyclitic process. The poor central vision sometimes found in cases of mild iridocyclitis may quite frequently be attributable to macular changes of this type.

The retinal periphery was both degenerate and saturated with iron. Pigmentary changes were marked, the migrating hexagonal cells being full of iron corpuscles. This last finding was a further confirmation of the phagocytic capacity of the mobile pigmented epithelial cells. A granular substance with minute eosinophil specks was situated between Bruch's membrane and the retina. The retinal changes corresponded to a regressive process—comparable to an abiotrophy. In both processes: (1) The location of the main changes was predominantly peripheral. (2) The nuclear layers were reduced. (3) The glial scaffolding was increased and associated with a tentaclelike migration of hexagonal cells through all the layers of the retina. (4) In both processes, where visual function was preserved, twilight vision was the first to fail.

The (fatty) degenerative, posterior pannus may be yet another expression of a dystrophic process. It is noteworthy that, up to now, changes of the last type have been found in disciform macular dystrophy and in senile retinal changes exclusively.

SUMMARY

Examination of an eye which had retained an intraocular iron foreign body for 22 years revealed the following points of interest:

1. The corneal epithelium, corneal lamellas, Descemet's membrane, and endothelium were practically iron free, while

Bowman's membrane was packed with particulate masses of spherical bodies containing iron.

2. The iron-saturated zonular fibers had ruptured, and the lens was shrunk, deformed, and freely movable in the vitreous. The lens capsule was split, as in fireworkers cataract or in senile and glaucomatous capsular exfoliation, but was iron free. The capsular epithelium was degenerate and contained iron.

3. A cystic degeneration of the macula was iron free but showed eosin-stained exudates and fatty corpuscular cells. Macular ganglion cells were swollen and fading.

4. The retinal periphery was heavily impregnated with iron and degenerate. Glial growth predominated.

5. The choroid was far less impaired.

6. The peripheral hexagonal cells were degenerate, packed with iron, and located for the most part along broad glial bands in the retina.

7. There was a granular substance between the choroid and retina with a remarkable, probably vascular, network, a highly developed posterior degenerative pannus, the vessel walls of which were completely infiltrated with fat.

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ACCOMMODATIVE ASTIGMATISM*

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It has frequently been observed that a difference in the amount and/or axis of astigmatism occurs during accommodation. Those who have carefully measured the amount of astigmatism during accommodation have found an increase necessary in the amount of cylindrical correction at near. However, a review of the literature reveals but few systematic investigations of this phenomenon. During the course of routine refractions here in the Clinic, our interest in this change was aroused. Those patients who have complained of discomfort during reading or at near were investigated in order to ascertain what part this near astigmatism played in their symptoms. We have attempted, therefore, to amplify and, if possible, to offer a more systematic and complete approach to this problem. The medical background for this change has been reviewed and a formula sufficiently accurate for our work is offered. The importance of these differences to the clinical ophthalmologist will be evident when considering the adequate correction of large cylindrical errors especially in young people. The near visual distance referred to in this paper is 16 inches and the distance vision is 20 feet, and any references to the near or distance vision will be to these distances only.

In explanation of these differences, that is, changes in the amount of astigmatism during accommodation, the following factors have been offered:

1. Asymmetrical or sectional changes of the crystalline lens during accommodation.

2. A change in the optical effectivity of

the spectacle lens at near due to accommodation.

3. Changes in the vertical meridian (cyclotorsion) of the eye during convergence and depression with resulting changes in the axes of astigmatism.

4. Changes in the corneal radii following convergence and depression of the eyes.

5. Changes in the shape and position of the crystalline lens itself during accommodation.

The idea that an asymmetrical contraction of the ciliary muscle could cause astigmatism was suggested by Dobrowolsky¹ in 1868. This might easily follow since lenticular astigmatism could readily be the cause of the differences found between subjective astigmatism and keratometric readings. In order to ascertain the existence of meridional lenticular accommodation, Hess² performed the following experiment. Two fine, white, cotton threads were used as test objects, these being mounted on separate supports and so arranged that each could be moved to and from the eye along the visual axis. The threads were placed at right angles to each other, these axes corresponding to the principal axes of the astigmatism. Each was now set at that distance at which the thread would be sharply defined in accordance with the previously measured astigmatism. If one thread were moved nearer the eye, an attempt to accommodate in this meridian would occur. Whether the other line remained clear or appeared blurred would be evidence for or against the existence of lenticular accommodation. Hess observed 23 cases, and in his series the astigmatic accommodation found was only of the order of

* From the Dartmouth Eye Institute.

0.1 D. Some of these changes might have been due to a rapid fluctuation in the total accommodation corresponding to the interval of Sturm.

This subject has been thoroughly reviewed by Erggelet,³ who coined the term near-astigmatism (*nahastigmatismus*). Erggelet was not of the opinion that asymmetrical lenticular changes were the cause of the increase in astigmatism during accommodation.

A few authors have written of changes observed in testing astigmatic subjects at 20 feet and 16 inches, the conclusion being drawn that these changes were due to meridional lenticular astigmatism. Lancaster⁴ reported a case, in 1916, of astigmatic accommodation in a patient following an attack of food poisoning in which the central nervous system become involved. The astigmatism varied in one eye from +0.75D. cyl.ax. 20° to +2.75D. cyl. ax. 80° through a six-months period. Under cycloplegic +0.25D. cyl.ax. 90° was measured. Lancaster concluded: "... It was natural to surmise that the change was due to a change in the action of the ciliary muscle. As the nuclear cells recovered from the damage by the toxin, some cells would recover better than others, and so the part of the ciliary muscle under their control recover tone better than the other parts; from this would result an unequal tension on the suspensory ligament and a consequent unequal curvature of the anterior surface of the lens."

Sheard⁵ also found astigmatic changes of from $\frac{1}{2}$ to $\frac{3}{4}$ D. at short-fixation distance, and he concluded that the possibility of accommodative astigmatism does exist.

In a recent paper by Hughes,⁶ eight cases of change in axis of astigmatism with accommodation were reported. However, only the fifth case presented can actually be said to give evidence of lenticular astigmatic accommodation. In this

case, a rupture of some of the zonular fibers was observable. Four of the remaining seven cases were presbyopic which eliminates the accommodation factor, and in three cases, corneal or lenticular pathologic conditions were noted. Sugar⁷ reported a study of 70 cases and observed changes in axis of the astigmatism at near, but apparently he made no attempt to determine the changes in *amount* that should occur in near vision. In both Hughes' and Sugar's papers, a change in the axis of astigmatism at near was noted but the increase in astigmatism at near when accommodation occurs was not considered.

Differences in the axis of astigmatism at near might be explained by a change in the cyclotorsional position of the eyes as they accommodate and turn downward. Because of the tendency for a cyclotorsional movement of the eyes to be associated with convergence, a regular shift of axis might be expected. However, generally this change is small and is ordinarily below the precision with which the axes can be determined.⁸ Large cyclophorias may occur with convergence in some individuals which would undoubtedly affect the axis of the astigmatic correction.

Two points should be remembered when dealing with astigmatism at the near point. First, there is a demonstrable change in the optical effectivity of the cylinder at near for an accommodating eye. Second, the astigmatism at near will be different with different methods of testing; that is, the use of different types of targets, such as letters, charts, and so forth.

EFFECTIVITY OF A CYLINDRICAL LENS FOR NEAR VISION

When the eye changes its fixation from a distant object to one at near, and accommodation occurs at the same time, it can be shown that the cylindrical effectivity of the lens correcting the astigmatism also changes. Percival⁹ notes: "After

correcting a high degree of astigmatism and obtaining a visual acuteness of 6/6 . . . I have often been disappointed with the result I obtained when testing the patient's near vision. . . . I determined to see if the effective value of the cylinder was altered when used for near work. To my surprise and delight I found that this was so, and my difficulty was thereby explained." The astigmatism of the accommodated eye, corrected for distance, becomes slightly undercorrected, the effectiveness of the correction less. This effect was called "near astigmatism" (*nahastigmatismus*) by Erggelet to designate the apparent increase in the astigmatism that occurs when the eye wearing a correcting astigmatic spectacle accommodates for near visual distances. Therefore, a subject with an astigmatism of high degree can be fully corrected for 20 feet, but when accommodating at 16 inches, the effect of the cylindrical lens is decreased, and conversely the subject's astigmatism will appear increased.

A sufficiently accurate formula from which the required near cylinder can be computed, when the strength of the distance cylinder is known, is:

$$C_n = C_d [1 + 2h(\frac{1}{p} - A)]^*$$

where C_n and C_d are the astigmatic correction for near and distant vision; p is the near distance (in meters) from the lens, h is the distance of the lens from the eye and A is the spherical addition ("add") to the lens for near vision. In presbyopia an adequate near "add" must be included in the correcting lens. In this

case, then, $A = \frac{1}{p}$ and thus the effec-

tivity of the near cylinder is equal to the distance cylinder. When the eye fully accommodates in looking from 20 feet to 16 inches, no "add" is needed and consequently $A = 0$, and C_n will be different from C_d . For a 1.00 D. correcting lens at 15 mm. from the eye and using a reading distance of say 30 cm., C_n will equal 1.10 C_d or the increase in the near cylinder will be in the order of 10 percent as compared to the distance cylinder.

Other sources of difference not included in the above formula may occur because of the following: In calculating the near astigmatism there will be a difference depending upon whether the more or less hyperopic meridian is taken as the reference for the accommodative change. The sphere used in sphero-cylinder combination may also, especially if high, affect the near astigmatism correction. The physical dimensions of the correcting lens used, especially thickness, will have a small influence. All these factors, however, introduce differences of the second order only, and can be neglected. We can thus see that in dealing with cylinders of large order, as Percival has noted, maximum visual acuity may not be obtained unless this change in near astigmatism is accounted for.

THE PRESENT INVESTIGATION

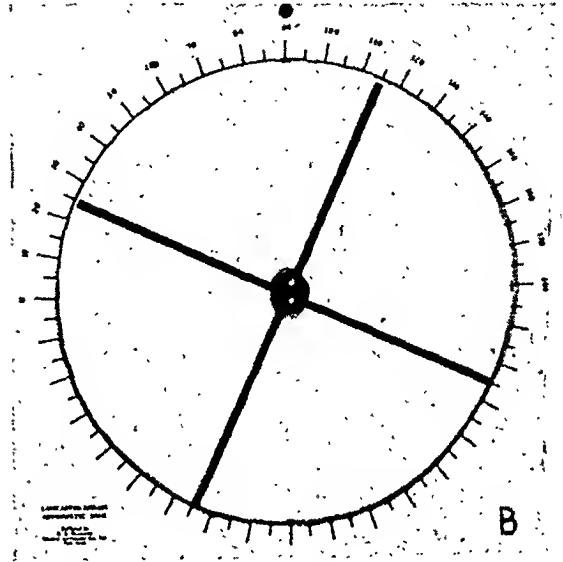
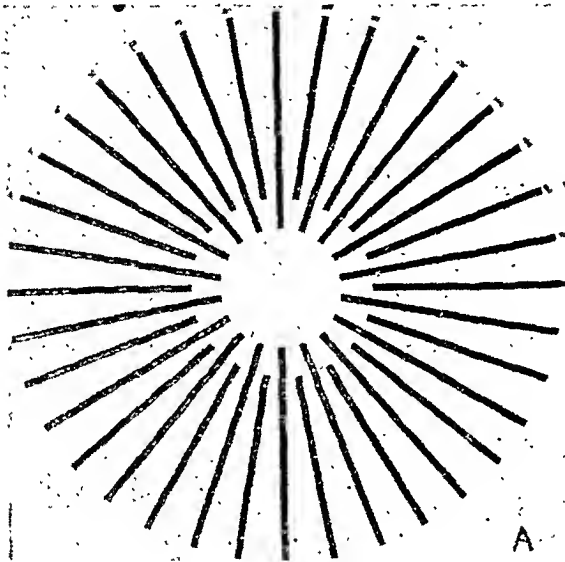
The essential contribution in the study reported here lies in the fact that three different methods of measuring the astigmatic error for both distant and near vision were used. Not only were changes in the amount of astigmatism at near measured, but also changes in the direction of the change of the axis at near were noted. The first method was the Lancaster-Regan astigmatic chart¹⁰ and dial. The second was the Jackson cross-cylinder test in which an attempt was made to maintain the strength of the

* We are indebted to Kenneth N. Ogle, Professor of Research in Physiological Optics, Dartmouth Eye Institute, for the derivation of this formula.

cross cylinder in keeping with the strength of the cylinder under estimation. The third was the method of stigmatoscopy which in our opinion offers the most accurate means of determining the amount and the axis of astigmatism at our disposal.

It was considered important that the

keep the posterior focal line of the interval of Sturm preretinal at all times. The effective fogging sphere was found by standard retinoscopic technique. For the near visual distance of 16 inches, reduced photographic reproductions of the Lancaster-Regan chart and dial as designed by Bannon¹¹ were employed. The chart



Figs. 1A and 1B (O'Brien and Bannon). For the near visual distance of 16 inches, reproductions of the Lancaster-Regan chart and dial were employed. These were attached to the opposite sides of a double sheet of heavy white cardboard. 1A, Near vision astigmatic chart. 1B, Near vision adjustable astigmatic dial. The dial was attached to the sheet of cardboard in such a way that it could be rotated by means of a handle through 90°.

technique employed in the near-vision tests should be as similar to those used for distant vision as possible. The cross-cylinder test on letters and the stigmatoscopy test are easily adapted for near-point estimation and the technique in each instance is substantially the same as that used for distance testing. However, in the case of the astigmatic chart and dial, there were none available for near-point use, and this resulted in our devising a near-point astigmatic chart and dial.

With the Lancaster-Regan astigmatic chart and dial, the system of adequate fogging together with the use of negative cylinders was followed. It was our aim to

and the dial were attached to the opposite sides of a double sheet of heavy white cardboard. The dial was attached in such a way that it could be rotated by means of a handle through 90°, in the same manner as could the large Lancaster-Regan dial (figs. 1A and 1B). This adaptation of the chart and the dial for use at near vision was found simple and yet effective in use. The dynamic cross-cylinder test¹² gives an indication of the amount of plus sphere necessary to place the conjugate foci in front of the retina. On the average, it was found necessary to add +0.50D. sph. to the distance correction in nonpresbyopic cases so that the patient would be properly

fogged for the near-point astigmatic test. The same routine of fogging together with the use of negative cylinders was followed. Sufficient positive trial-case spheres were again used to keep the astigmatic foci of Sturm's interval anterior to the retina. The routine differed actually in no manner from that employed at 20 feet.

In the cross cylinder test, we followed the technique as outlined by Jackson.¹³ This method was used for both the 16-inches and the 20-foot tests. In dealing with high astigmatic errors, the stronger cross cylinders were used and vice versa when the errors were small. By using the cross cylinder of powers comparable to the astigmatism, higher precision will result.

The method of stigmatoscopy is based upon the ability of the eye to discriminate, with precision, the change in blurredness of the retinal image of a point source of light. The instrument¹⁴ is essentially a haploscope in which the mirrors are half-silvered. This permits binocular fixation and fusion of a suitable target before the eyes, and at the same time permits point light sources supported on the arms, to be seen by reflection, and appear superimposed upon the target. Each eye sees a different point light source. These sources are mounted on riders which can be moved along the haploscope arms, and are maintained along the fixation lines of the two eyes. As the distance of one of the point light sources is changed, its blurredness will appear to change. The patient is directed to turn a suitable knob (which in turn moves the source along the arm) until the light appears smallest and nearest. At this position the source is conjugate to the retina, and the distance from the eye in diopters is a measure of the refractive condition of the eye. In an astigmatic eye the light source can be focused for one and then the other of the

Sturm lines. The difference in distances (in diopters) from the eye is the measure of the astigmatism. Visual acuity tests are used in conjunction with the test to determine the final spherical correction. Repeated settings permit unusual precision.

We feel that by the above three methods we have given a more careful study to the problem than has heretofore been available. The comparison of the three methods gives a good cross-sectional view of the refractive problem, not only with respect to the astigmatism but also the spherical error.

RESULTS

The data will be presented with respect to differences in the amount of astigmatism at near and differences in axis at near. The data are from 25 cases, spread evenly through cylinder ranges of 0.50D. to 5.00D. The stigmatoscopy data have been rounded off to the nearest 0.25D. In obtaining the change in the amount of astigmatism at near, 0.25D. was used as the standard, and no attempt was made to estimate changes of smaller degree. With respect to the change in axis, changes of 2 degrees represented the general amount of shift that could be accurately estimated.

A. DIFFERENCES IN THE AMOUNT OF ASTIGMATISM

An inspection of the table shows that there is on the average a small increase in the astigmatism at near, an increase that is consistent for all three tests. Only in one case was there a decrease at near. The average quantitative increase is shown in the scatter diagram in Figure 2, where the data are for the astigmatic chart and dial method. Clearly the points representing the measurements cluster about a line that has a slope about 10 percent higher than if no change in astigmatism

had been found. Thus on the average the astigmatism at near is measured 9 percent to 10 percent greater than is measured at distant vision. A comparison of the three tests as tabulated with respect to the increase in cylindrical power necessary to correct the astigmatic error at near is shown in Table 1.

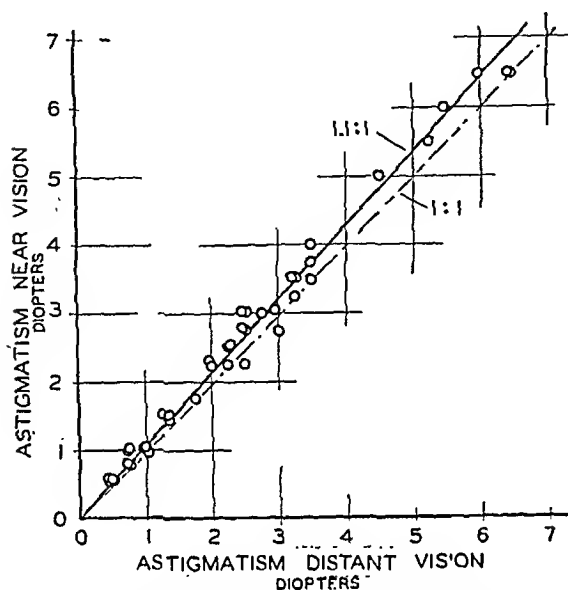


Fig. 2 (O'Brien and Bannon). Scatter diagram showing change in astigmatism at near vision.

An increase in the astigmatism at near of about 9 percent should be expected in those cases where there is adequate accommodation (table 2).

B. DIFFERENCES IN AXES OF ASTIGMATISM

In studying the change in axis of the astigmatism from distance to near vision,

TABLE 1

INCREASE OF CYLINDER MEASURED AT NEAR
(Number of Eyes = 50)

Diopeters of Astigmatism	Astigmatic Chart and Dial	Cross Cylinder Test	Stigmatoscopy
0 to 1.00 D.	12.0%	11.5%	11.1%
1.00 to 2.00 D.	4.9%	3.1%	5.11%
2.00 to 3.00 D.	9.0%	8.8%	9.03%
3.00 to 4.00 D.	3.4%	6.0%	9.1%
4.00 — up D.	9.1%	9.0%	9.2%

one must keep in mind that the precision of the measurements is much less for weak cylinders than for strong. In Table 3 are shown tabulated the average number of degrees change in astigmatism for the

TABLE 2

CALCULATED INCREASE IN CYLINDER AT NEAR READING DISTANCE

Convex		Concave	
C _d Distance Cylinder	C _n Equivalent Near Cylinder	C _d Distance Cylinder	C _n Equivalent Near Cylinder
+ 1.00	+ 1.092*	— 1.00	— 1.093*
+ 2.00	+ 2.183	— 2.00	— 2.188
+ 3.00	+ 3.272	— 3.00	— 3.284
+ 4.00	+ 4.360	— 4.00	— 4.382
+ 5.00	+ 4.447	— 5.00	— 5.481
+ 6.00	+ 6.532	— 6.00	— 6.581
+ 8.00	+ 8.699	— 8.00	— 8.785
+ 10.00	+ 10.860	— 10.00	— 10.995

* The third decimal point may be omitted from these two columns.

TABLE 3

CHANGES FOUND IN CYLINDER AXES BETWEEN DISTANT AND NEAR
(Number of Eyes = 50)

Diopeters of Astigmatism	Astigmatic Chart and Dial	Cross Cylinder	Stigmatoscopy
0 to 1.00 D.	3.5°	7.5°	8.1°
1.00 to 2.00 D.	6.1°	7.5°	7.0°
2.00 to 3.00 D.	3.9°	4.0°	4.2°
3.00 to 4.00 D.	1.8°	3.8°	4.0°
4.00 — up D.	2.3°	1.0°	2.4°

different strengths of the cylinder correction. Greater differences are found for the weaker cylinders, but of a magnitude which is believed greater than the variations that would occur in the precision of measurement.

In Table 4 are the tabulated results on the direction of these changes in axis. The significance of the difference in direction of these changes may be better appreciated if one considers that the stigmatoscopy

test is binocular; whereas, the chart and dial tests were monocular. One can see from Table 4 that there is a tendency for the superior pole of the vertical axis of the eye to rotate outward when tested binocularly as with the stigmatoscopy. Also it can be noted that, in testing mon-

TABLE 4
DIRECTION OF AXIS CHANGES AT NEAR
READING DISTANCE (16 INCHES)

	Astig. Chart (No. of Cases)	Cross Cyl. (No. of Cases)	Stigma- toscopy (No. of Cases)
Inward rotation of upper pole of vertical axis	9	9	14
Outward rotation of vertical axis	14	13	7
No change in axis	2	3	4

ocularly, this tendency toward outward rotation of the upper pole of the eye is less marked. Whereas, the number of eyes examined in this series is not considered significant enough to warrant a definite conclusion, it can be seen that relation of depression and convergence and cyclotorsion of the eyes when accommodating for near reading distances is most important.

Many more eyes should be used in an experiment of this type, for with the number of variables present, a greater number of cases in each category are really necessary before a fully satisfactory statistical study can be made. However, these data are significant and warrant their being summarized at this time.

SUMMARY

The astigmatism was measured on 50 eyes for distance and near vision by three techniques: (1) the Lancaster-Regan chart and dial, (2) the cross-cylinder, and (3) the stigmatoscopy methods. A consistent increase in astigmatism of from

8 percent to 10 percent was measured for near vision by all three methods. This increase was in the direction and approximate amount to be expected due to the loss in effectivity of cylinders prescribed for distance vision when used for near vision, before a fully accommodating eye. For astigmatic errors of the lower powers this factor is negligible, but for higher powers it should not be neglected.

Change in axes of the astigmatism was also found but there was no trend in this change consistent with changes in cyclotorsional positions of the eyes with convergence or lowering of the eyes.

CONCLUSION

If we have stimulated the interest of the practitioner in looking for these changes, the purpose of this paper has been achieved. Suffice it to say that the facts exist, but by and large they have been overlooked or ignored by most practitioners. Their importance is evident when one considers the problem of large astigmatic errors in young people. We have attempted to demonstrate that the distance refraction cannot in itself be considered accurate at near when astigmatism is involved to any significant degree. The difference between the rote method of refraction and that of the skillful refractionist's will be reflected in the results obtained. Changes in amount and/or axis of astigmatism at the near point should be looked for, and with a full knowledge of the results to be sought and the methods applied, one more weapon in the armamentarium of the competent refractionist is available.

The authors wish to acknowledge, with gratitude, the advice and inspiration received from Dr. Walter B. Lancaster.

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INVOLVEMENT OF THE ORBIT IN CHRONIC INFLAMMATION OF THE FRONTAL SINUS*

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It is a well-established fact that chronic diseases of the frontal (and ethmoid) sinus may involve the orbit. Among these diseases, the mucocèles and pyocèles are most frequent, causing pseudotumors in the inner and superior angle of the orbit. In fact, the tentative diagnosis of mucocèle is almost immediately made when there is a tumor covered by normal skin in the inner and superior angle of the orbit, above the internal palpebral ligament. It is of minor importance whether or not there is a displacement of the eyeball and whether palpation of the tumor yields fluctuation.

The purpose of this paper is to demonstrate: (1) that tumors in the inner and superior angle of the orbit are not always caused by mucocèles of the frontal and ethmoid sinuses; and (2) that extension of chronic inflammation of the frontal sinus does not always occur into the inner and superior angle of the orbit.

Tumor formation in the inner and superior angle of the orbit may occasionally indicate a pathologic condition in the orbit without involvement of the paranasal sinuses. In this respect, the so-called pseudotumors of Birch-Hirschfeld¹⁻⁹ are of great interest. The term denotes a finding which usually shows proptosis, limitation of eye movements, increase in bulk of the orbital tissue, and possible swelling of the lids. The onset is slow, and the usual signs of inflammation are absent. The etiology of pseudotumors of

the orbit is not known, although in several cases tuberculosis, syphilis, or focal infections were considered responsible. Pseudotumors are not frequent; nevertheless, the clinical evaluation of these granulomas is important from a practical standpoint, since there are instances reported in which an exenteration of the orbit was performed under the pretext of removing a malignant tumor.

Although in the advanced stage pseudotumors may give the impression of malignant orbital tumors, in the early stage they might be considered as being rhinogenic in origin. As pointed out by Meller^{5,6} pseudotumors are frequently noticed first at the superior, or superior and mesial, margin of the orbital opening, at a site which is likewise occupied by mucocèles or abscesses originating in the paranasal sinuses.

CASE REPORTS

The following case is of interest because it did not present the eye symptoms which are supposed to be typical in instances of pseudotumors.

CASE 1

History. J. F., a man aged 32 years, noticed about eight years ago a swelling the size of a pea in the inner angle of the left eye. This grew slowly to the size of a cherry stone. He was never injured at that site. Three years ago, a surgeon incised the swelling and removed part of it. Following the operation, the tumor became even larger than before. Eight months later, the tumor was again removed by another surgeon. After this operation, the eye was closed and swollen for five weeks. Four months after the

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second operation, the tumor again recurred. The patient did not complain of headache. Occasionally, there was a great amount of mucous discharge from the nose, and this was followed by a decrease of the swelling over the eye.

Examination. On examination, June 15, 1945, there was a swelling in the inner



Fig. 1 (Benford and Brunner). Note the scar in the inner angle of the left eye after removal of a pseudotumor.

angle of the left eye, located above the internal palpebral ligament and covered by normal skin. The swollen area extended over the bridge of the nose toward the glabella. In the skin, small surgical scars were noticed.

The tumor had a medium-soft consistency. The left palpebral fissure was narrower than the right. Eye movements were normal, and there was no exophthalmos. The right nostril was normal. On the left side, the agger nasi and the uncinat process were bulging. There was no secretion in the nose. X-ray films

showed a slight haziness of the right ethmoid, right-frontal and right-maxillary sinuses. The left frontal sinus was not developed. The left ethmoid was clear; the left maxillary sinus was slightly hazy. There were no signs of tuberculosis, lues, or leukemia. The tentative diagnosis of a mucocele of the left ethmoid was made. On July 5, 1945, an arcuate incision was made in the inner angle of the left eye under local anesthesia. In the supraorbital arch, a diffuse, soft swelling was found, the puncture of which did not reveal fluid. The periorbit was elevated down to the posterior lacrimal crest, and a communication to the nose was created through the frontal process of the maxilla.

A tumor the size of a date was found. This apparently had the insertion on the posterior lacrimal crista. The tumor penetrated the orbital septum and extended toward the glabella and to the center of the supraorbital arch. In the orbit, the tumor was located between the periorbit and the bone; at the forehead, between the skin and the thickened periosteum of the bone. Numerous branches of the anteriorethmoidal and supraorbital nerve passed through the tumor. These branches were severed, and the tumor was removed by blunt dissection. The hemorrhage was considerable. After removal of the tumor, a shallow groove was found in the frontal squama together with a thickening of the lacrimal bone. Uneventful recovery ensued. There was no recurrence during an observation period of nine months (fig. 1).

Microscopic Examination. The tumor consisted of connective tissue, striated muscle fibers, small blood vessels, and nerves. The connective tissue was firm. It did not show degeneration nor definite signs of inflammation. The nerves were normal, as were the walls of the small arteries. The small veins showed a peri-

vascular infiltration consisting of loosely arranged lymphocytes and plasma cells. Occasionally the cells were adjacent to only one wall of the vein, while the opposite wall did not show infiltration.

The muscular tissue occupied the greater part of the specimen. The muscle fibers were to a great extent entirely normal. There were, however, several lo-

form follicles and invade the muscle fibers, the remnants of which could be seen between the lymphocytes (fig. 3). There were no giant cells.

Comment. In this case, the erroneous diagnosis of a mucocoele was based upon a misleading history given by the patient. Since there was no exophthalmos or limitation of eye movement, it was scarcely



Fig. 2 (Benford and Brunner). Note the accumulation of lymphocytes between the muscle bundles and along the capillaries.

calized spots presenting different changes. The slightest change consisted of an edema of the muscle. At these sites, the muscle fibers might show a normal structure, or they might have lost their striation and be broken up into several pieces. Between the muscle fibers, there were usually a few scattered lymphocytes. At other sites, there was an accumulation of lymphocytes and plasma cells between the muscle fibers, usually surrounding a capillary (fig. 2). These accumulations of lymphocytes might reach such a size that they could be seen macroscopically. In such instances, the lymphocytes might

possible to make the correct diagnosis. The operation was hemorrhagic; nevertheless, the tumor was removed since it did not extend too far into the orbit and was fairly well encapsulated. Whether or not the cure is definite, cannot be stated because in these instances, recurrences in the same or in the other eye may occur after a period of several months. In the event of a recurrence, the appropriate treatment would be administration of iodine and arsensics, and eventual X-ray therapy, rather than surgical intervention.

According to Birch-Hirschfeld,³ the principal microscopic features of these

tumors are: (1) Accumulation of lymphatic tissue. (2) Proliferation of the intima and hyaline degeneration of the walls of the blood vessels. In the presented case, the changes in the blood vessels were absent, but the accumulation of

of animals. This concept likewise does not agree with the findings in the presented case, since the accumulation of the lymphatic tissue was found almost exclusively within the muscular tissue covering the supraorbital arch.

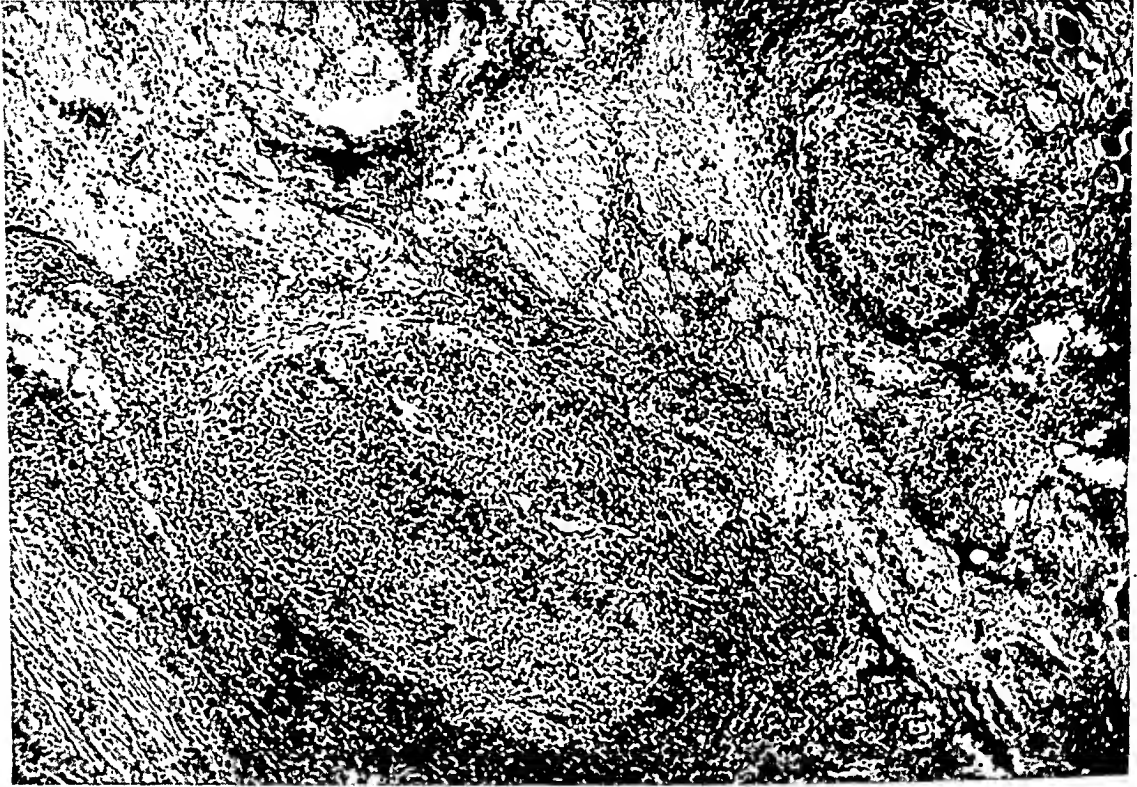


Fig. 3 (Benford and Brunner). Microscopic section showing two lymph follicles and lymphatic infiltration between the muscle fibers.

lymphatic tissue was marked and the formation of follicles was noted.

The pathogenesis of the lymphatic tissue is not clear. Several ophthalmologists believe that it derives from the small amount of lymphatic tissue which is found in the fornix conjunctivae and near the lacrimal gland under normal circumstances. This concept does not agree with the finding in the presented case since the tumor had no relation to the fornix or the lacrimal gland. Birch-Hirschfeld claims that the lymphatic tissue may originate from the lymphatic crevices which he has found in the orbits

In striated muscles, lymph vessels are found only on the outside, but they seldom extend into the muscle along the broad connective tissue septa, and are never found between the muscle fibers (Schaffer). For this reason, the lymphatic tissue did not originate from the lymph vessels of the muscle. The microscopic examination revealed that the lymphatic tissue apparently originated from the capillaries between the muscle fibers. Neither microscopic examination nor clinical observation gave any information concerning the etiology of the pseudotumor in the presented case.

Although the tumor of the orbit in Case 1 was erroneously considered to be of paranasal origin, inflammatory tumors of the orbit of definite paranasal origin were found in Cases 2 and 3. This finding is important because inflammatory tumors of the orbit arising from the paranasal sinuses are practically unknown, if one excepts the rare occurrence of tuberculosis of the ethmoid which extends into the orbit. This contrasts sharply to the incidence of acute inflammation of the orbit originating in the paranasal sinuses which accounts for about 60 percent of all cases.

CASE 2

Z. B., a white woman aged 21 years, was hit in the region of the mesial canthus of the left eye by a peach pit shot from a sling shot. Shortly after this accident occurred, 12 years ago, she injured her nose in the region of the left eye by bumping herself on a desk. Soon after these two injuries, she noticed a swelling in the region of the inner canthus of the left eye. This was accompanied by considerable pain in that area and in the eye, as well. Intermittently, the pain was so severe that her eyeball felt like it was going to burst. The pain continued, and the swelling advanced, involving the mesial angle of the eye (fig. 4). At times the eye swelled shut and became black. These attacks came on when she had a head cold or became nervous. Cold wind or night air would start the pain. Soon after, the swelling would increase and become discolored. As soon as the head cold subsided, the black color would rapidly disappear.

About five years before this examination, there was a yellowish discharge from the nose. This discharge continued and became worse when the patient had a cold.

Examination. At admission, June 8,

1944, a swelling was found at the inner angle of the left eye above the internal palpebral ligament and extending toward the bridge of the nose and the glabella (fig. 4). The swelling was covered by normal skin and had a doughy consistency. There was no defect of the



Fig. 4 (Benford and Brunner). Note the tumor in the inner angle of the left eye.

underlying bone. The left eye seemed to be slightly displaced downward. The left middle turbinate was slightly hyperplastic, but there was no other pathologic condition in the nose.

X-ray studies showed the following: Absence of the left frontal sinus; absence of a part of the mesial superior portion of the left orbit with some upward displacement of the margins of the defect and sclerosis of that area; clouding over the left ethmoidal, maxillary, and sphenoidal sinuses (fig. 5). Wassermann and Kahn tests were negative. It was not

possible to make a definite diagnosis. The tentative diagnosis pointed to either a chronic osteomyelitis of the left supra-orbital ridge or to a mucocele of the ethmoid.

Under general anesthesia, an arcuate incision was made in the inner angle of the left eye, and immediately a large mass of granulation tissue was exposed. The hemorrhage was formidable, and it was

Two days after the operation, there was a marked swelling of the skin over both upper lids and forehead, but there was no redness of skin. There was no pain and no fever. Nevertheless, the wound was partially opened, and 10,000 units of penicillin in 5-percent glucose were administered intravenously over a 10-hour period. The patient made an uneventful recovery, and 11 months later she felt fine,



Fig. 5 (Benford and Brunner). a. Chronic osteomyelitis of the left supraorbital ridge. b. Small frontal sinus on the left side.

extremely difficult to separate the thickened and granulating periosteum from the floor of the frontal sinus. The granulating periostitis extended deeply into the orbit along the superior and the mesial walls. The frontal bone was uneven, sclerotic, and anemic. There was no pus.

Since the condition of the patient did not permit the removal of the floor of the frontal sinus, the frontal process of the maxilla was removed, and the anterior ethmoid was curetted in order to perform a wide drainage of the periostitis into the nose. There was no involvement of the posterior ethmoid. The skin incision was partially closed.

had good appetite, and was gaining in weight. There was almost no headache, but the tumor in the inner angle of the left eye had not changed.

Comment. This was a typical case of primary, chronic osteomyelitis of the frontal bone following injuries to the bone. Usually an infection of this type causes a thickening and sclerosis of bone, eventual necrosis, formation of sequestra, and an infection of the frontal sinus. In the presented case, the disease ran over a period of 12 years, and the outstanding symptoms were severe headache, toxemia, and a tumor formation in the inner angle of the left eye.

The tumor consisted of granulations which were covered by a normal skin. The granulations were caused by a granulating periostitis (fig. 6) which extended deeply into the orbit. This is an occasional finding in syphilitic periostitis of the frontal bone. However in the presented case, the Wassermann and Kahn

for three reasons: (1) The patient had not given consent to that type of operation, since a definite diagnosis had not been made prior to surgery. (2) The operation would have resulted in a bad disfiguration of the face. (3) The simple exposure of the frontal sinus had caused such a formidable hemorrhage that

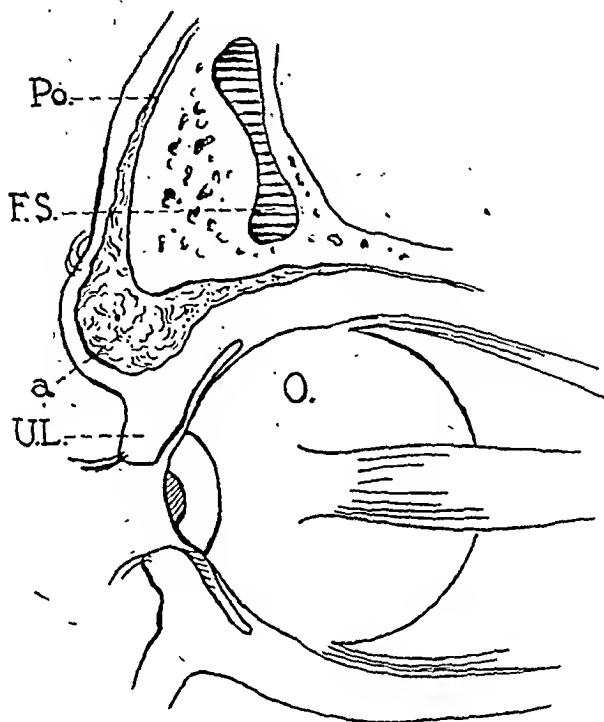


Fig. 6 (Benford and Brunner). Po, Periosteum; F.S., Frontal sinus; a. Tumor consisting of granulation tissue, due to a granulating periostitis; U.L., Upper lid; O. Eyeball.

tests were negative. This case proves, therefore, that common chronic osteomyelitis of the frontal sinus may occasionally cause inflammatory tumors of the orbit which consist of granulation tissue and are due to a granulating periostitis of the anterior and inferior sinus wall.

The excruciating pain which the patient was suffering, required surgery. The proper operation would have been the removal of the entire osteomyelitic area. This operation was not performed

a radical operation upon the thickened and sclerotic bone would have been fraught with hazards.

For these reasons, it was decided to create a decompression of the orbit into the nose. The frontal process of the maxilla and the anterior ethmoid were removed so that the granulations could bulge into the nose. The result of this decompression was satisfactory. The patient was almost completely relieved of headache, gained weight, and was in good spirits. Nevertheless, it is questionable

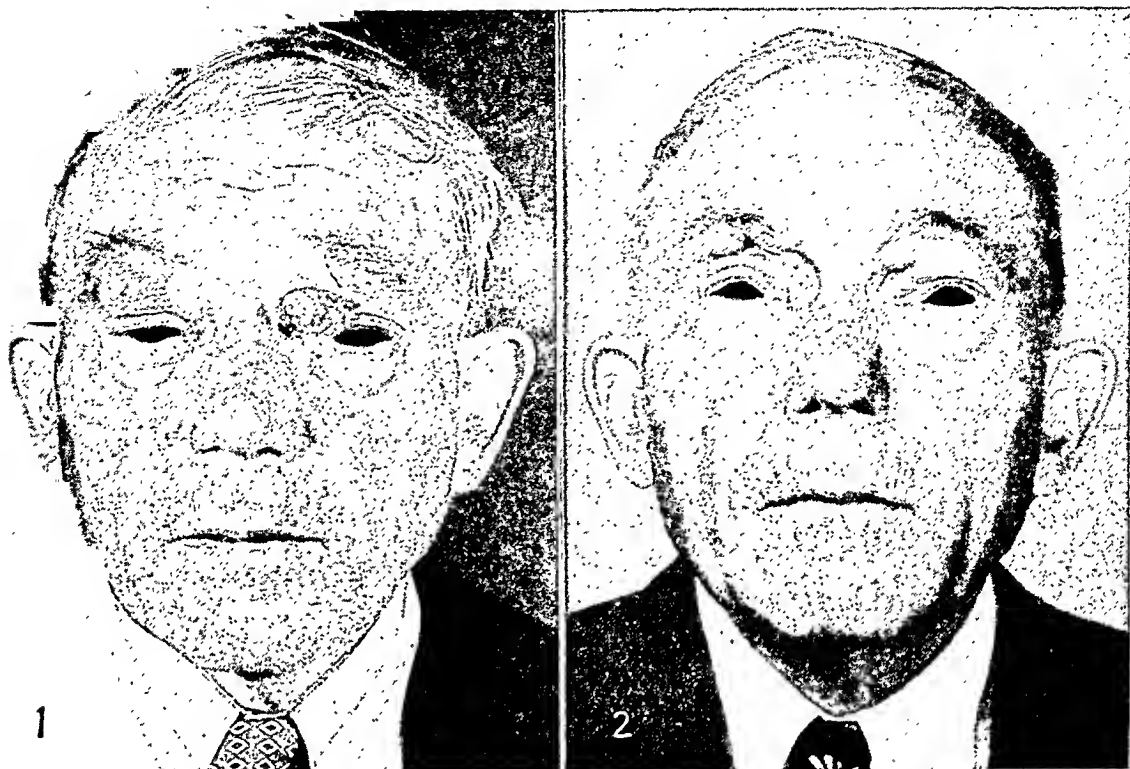


Fig. 7 (Benford and Brunner). 1. This picture indicates the findings prior to operation. Note the tumors in the outer angle of the right eye and in the inner angle of the left eye. 2. This shows the patient after the operation.

whether or not this result will be permanent.*

CASE 3

J. M., a man, aged 61 years, fell on his head from a horse 40 years before. Three years ago he noticed a bilateral growth above both eyes. An unsuccessful operation was performed. Polypi were removed from the nose on April 22, 1944. Bone was found within the polypi. This operation likewise had no influence upon the tumors above the eyes. There was an occasional headache.

Examination. On examination, October 19, 1945, a tumor, 1.5 x 2 cm. was found, covered by normal skin. It was located in the lateral part of the right upper lid (fig. 7). The tumor pushed the eye downward and narrowed the palpebral

fissure; it also raised the lateral part of the eyebrow.

On palpation, the tumor presented a fluctuating encapsulated mass which apparently protruded through a perforation in the floor of the right frontal sinus. The margins of the opening in the floor of the sinus were markedly thickened.

The right eye was normal except for a slight restriction of the movement upward. In the mesial portion of the left upper lid, there was an opening in the skin about the size of a penny. The margins of the opening were sharp, not granulating, and a tumor the size of a normal ovary emerged through the opening.

The tumor consisted of polypoid tissue, and a small amount of mucopus escaped between the polypi. When pressure was exerted upon the tumor on the right side, a great amount of pus escaped between the polypi on the left side. The

* The result was not permanent, since headache returned several months later.

left eye was displaced inferolaterally. The skin over the left tear sac was inflamed, but there was no dacryocystitis. The supraorbital ridge on the left side was uneven but intact. Conjunctiva and eye movements were normal on the left side. The right nostril was filled with polypi. The left nostril was large; the

frontal sinus was exposed and found to be normal except in the most lateral part where a narrow fistula was noticed. A sac filled with pus emerged through the fistula. The walls of the sac were firmly adherent to the periorbit and were a continuation of the mucosa of the frontal sinus. In other words, the tumor of the

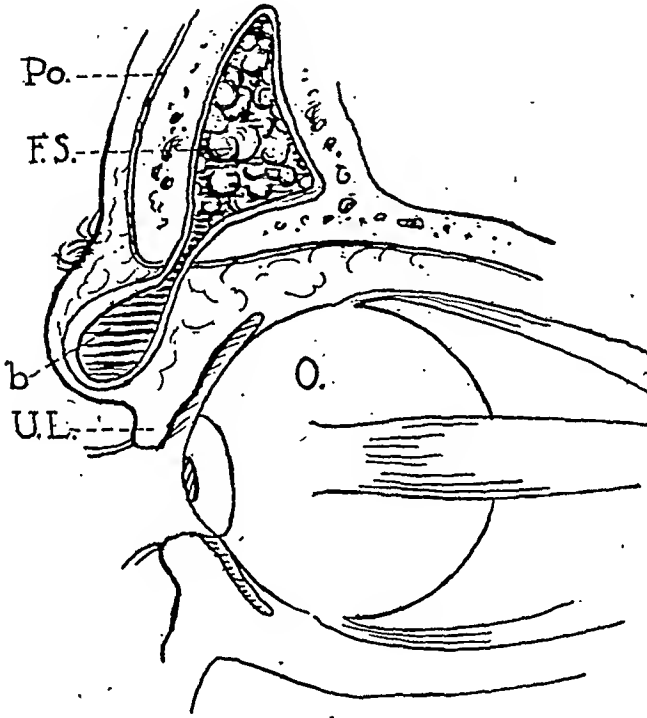


Fig. 8 (Benford and Brunner). Po, Periosteum; F.S., Frontal sinus; b, Herniation of the frontal sinus mucosa, filled with pus; U.L., Upper lid; O, Eyeball.

inferior turbinate atrophic. There were two large polypi, both apparently originating in the ethmoid. The epipharynx was filled with mucopus, and the breath had a foul odor.

X-ray films showed an increased density over the left maxillary antrum, ethmoids, sphenoids, and frontal sinuses. On October 20th, the tumor in the right upper lid was exposed, the capsule incised, and 20 cc. of pus were aspirated. The pus contained hemolytic staphylococcus aureus.

An arched incision was then made below the right eyebrow. The floor of the

right upper lid was caused by a herniation of the mucosa of the frontal sinus which had escaped through a narrow fistula in the floor of the sinus (fig. 8).

Next, the floor of the sinus was removed. The entire sinus was filled with polypi which extended into the sac that emerged through the fistula. A part of the frontal process of the maxilla, including a part of the apertura piriformis, was found to be transformed into a sequestrum. The sequestrum was removed. This created a large opening into the nose. The anterior ethmoid was curetted.

The next step was to make an arched incision below the left upper eyebrow. There was a large perforation in the floor of the frontal sinus and in the lateral wall of the anterior ethmoid. Through this large perforation protruded polypi which were in direct connection with the polypi forming the tumor in the upper eyelid.

The left frontal sinus, which had a

the opening into the nose. After removal of the membrane, the right ethmoid was found to be filled with polypi and bony sequestra which were remnants of the bony septa between the ethmoid cells. The polypi were thoroughly removed, and the fistula in the left upper eyelid was closed. Uneventful recovery ensued.

Microscopic Examination. The sac on the right side (fig. 9) consisted of con-

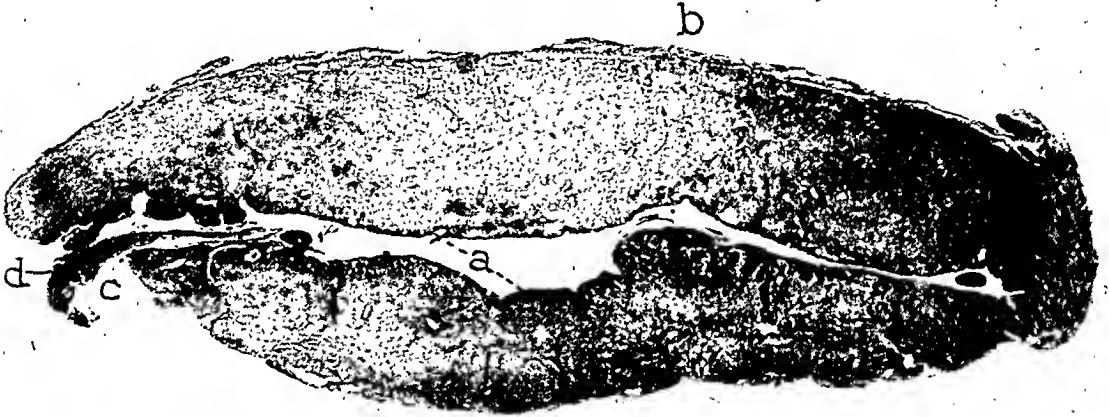


Fig. 9 (Benford and Brunner). Section through the herniation of the frontal mucosa on the right side. a. Squamous epithelium; b. Blood vessels with perivascular infiltration; c. Opening of the sac toward the frontal sinus; d. Fibrin within the opening.

large temporal recess, was entirely filled with polypi that extended through a perforation in the interfrontal septum into the right frontal sinus. All polypi were removed. The posterior walls of both frontal sinuses were normal.

On the evening following the operation, the patient's temperature rose to 104°F. (rectally) due to a bronchitis. Penicillin was given, and the temperature fell gradually by lysis until it became normal on October 28th.

Since the right nostril was filled with polypi and bony sequestra were palpated within the polypi, an external ethmoid operation was performed under local anesthesia on November 24th. A thick connective-tissue membrane that had grown together with the periorbit had closed

nective tissue which was covered by an intact, somewhat thickened epithelium associated with papillary areas which were lined by respiratory epithelium. The latter zones were vascular and markedly infiltrated by round cells, while the former zones presented a moderate infiltration. The mass from the upper lid consisted of markedly edematous tissue associated with round-cell infiltration and with widely dilated blood vessels. The covering epithelium was markedly hyperplastic, thrown into irregular folds, and permeated by numerous polynuclear cells. Occasionally, there was respiratory epithelium. There was no evidence of malignancy. Within the polyoid tissue, atrophic bone trabeculae were found, apparently originating from the ethmoid

(fig. 10). The margins of the trabeculae were aplastic, and there was a loose connective tissue between them. There was no inflammation of the connective tissue.

Comment. This is a case of chronic, purulent infection of the frontal and

cranial complication. Rarely does the abscess in the orbit become encapsulated. In the presented case, there was an enormous amount of polypi within the sinus while the accumulation of pus was less conspicuous. The osseous wall was per-



Fig. 10 (Benford and Brunner). Section through the polypus in the left ethmoid. a. Hyperplastic squamous epithelium; b. Atrophic bone; c. Loose connective tissue; d. Edematous connective tissue.

ethmoid sinuses in which the infection has ruptured into the orbit. Cases of this type are by no means rare. However, in certain respects the presented case differs definitely from the usual type.

Commonly, an accumulation of pus is found in the sinus, and there is an osteitis, necrosis, and finally a fistula in the osseous wall. Through the fistula, pus escapes into the orbit causing an acute orbital infection which may subside spontaneously, or requires surgery, or eventually causes an intra-

forated on the left side, but it seemed as if this was caused primarily by pressure due to the polypi and not by an osteitis.

The following findings favor this concept. The patient gave no history of marked headache. If there had been an osteitis, he would have suffered from headache. The bone which was embedded in the nasal polypi was atrophic but did not show signs of inflammation. The margins of the skin fistula in the left upper lid were epithelialized, not granulating. No pus had escaped into the orbit, causing

an orbital inflammation; but polypi and sinus mucosa bulged into the orbit, causing pseudotumors of the orbit. The frontal sinus mucosa which bulged into the right orbit presented only a moderate degree of inflammation. This indicated that the absorption of the underlying bone was due to pressure rather than to infection.

Although absorption of bone due to pressure also occurs when mucocoeles or pyocoeles extend into the orbit, the tumor mass in the right orbit cannot, in this case, be considered a mucocoele or pyocoele. In mucocoele a large part of the osseous sinus wall—the size depending on the size of the mucocoele—becomes atrophic, bulges into the orbit because of the pressure of the mucocoele, and ultimately becomes absorbed. In the presented case, there was a narrow fistula in the floor of the frontal sinus, and the margins of the fistula consisted of thickened bone. Through the fistula, a comparatively large sac bulged into the orbit. The outside of the sac did not reveal any remnants of bone. For this reason, we considered that the finding in the right orbit was not a pyocoele, but a herniation of the frontal-sinus mucosa. Unless they are caused by

a malignancy of the paranasal sinuses, incidences of this type are rare. However, the clinical and microscopic examination did not reveal any signs of malignancy in this case; nor did the long duration of the disease favor the concept of malignancy.

CONCLUSIONS

1. Pseudotumors of the orbit (Birch-Hirschfeld) may occasionally occupy the inner and superior angle of the orbit, thus simulating a tumor of paranasal origin.

2. Inflammatory orbital tumors of rhinogenic origin do exist, but they are not as common as acute orbital infections of rhinogenic origin.

3. The inflammatory orbital tumors of rhinogenic origin arise from infections of the ethmoid and/or frontal sinus.

4. Inflammatory orbital tumors of rhinogenic origin may be caused by: (a) a granulating periostitis, (b) a herniation of the mucosa of the paranasal sinuses, (c) an invasion of the orbit by nasal polypi.

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OBSERVATIONS ON 300 CONSECUTIVE CASES OF OCULAR WAR INJURIES*

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The subject of ocular war injuries is of great importance in military surgery, not only for scientific and humane reasons but also from an economic standpoint. Many of the soldiers with eye injuries become unfit for further military service, as well as for many civilian occupations. Moreover, they form an economic group which requires tremendous expenditures for their postwar care. In modern times each succeeding war has shown an increase in the number of ocular injuries in relation to the number of injuries to all other parts of the body. It must be remembered that the incidence of ocular injury is likely to be underestimated rather than overestimated because many of the cases are associated with fatal head wounds.

It is not surprising that the eyeball, although measuring but 1/375 of the body surface, should be so frequently injured, if one considers the great vulnerability of the eye to small particles. For example, a minute flying particle which would be stopped by clothing or be unnoticed if embedded in the skin may cause a severe injury when it penetrates the eyeball.

It is for this reason that eye injuries form a larger proportion of all types of severe injuries as the distance from the explosion increases. Blake¹ reports that ocular injuries form two percent of all injuries occurring at distances from 0 to 50 feet and 14 percent of all injuries at 150 to 200 feet.

In World War I the incidence of ocu-

lar casualties rose to eight percent of all injuries. The data on the number of eye casualties in World War II are not yet available, and estimates by various observers differ widely. Vail² states that they comprised about two percent of all injuries in the European Theater. Loewenstein³ early in World War II found that 12 percent of all injuries were to the eye. Cordes⁴ believes that the percentage may even rise as high as 15 to 17 percent. MacFee⁵ found that in 141 Air-Force combat casualties 12 percent were ocular injuries. Schench⁶ and others surveyed 3,019 casualties on a hospital ship and found that 451 or 15 percent suffered eye injuries. Wisner⁷ reports that ocular injuries were present in eight percent of all casualties brought aboard a hospital ship.

The frequency of ocular injuries varies with the type of warfare. During a rapid advance, because the entire body of the soldier is exposed, there are relatively few ocular injuries. Such was the case after the break-through in Normandy. The incidence of ocular injuries rises when the battle front becomes static because the soldiers must take to trenches and foxholes, where the body is protected while the head and eyes are exposed for observation or shooting. This occurred during the campaign on the Italian front.

Other important factors in the rising number of eye casualties in modern warfare are:

1. The increased range and explosive power of high caliber shells and grenades.
2. The use of land mines, which frequently produce bilateral ocular wounds.

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3. The increased use of tank warfare, with the unavoidable exposure of the head and eyes of the tank commander.

It is the purpose of this report to record the findings of 300 consecutive cases of ocular casualties which were observed at a U. S. Army hospital designated as an Ophthalmic Surgical Center. .

The modern soldier may receive injury not only in combat but also as the result of noncombat duties (see table 1). Injuries to the eyes caused by flying chips of steel, glass, rock, or sharp implements, similar to those observed in civilian life and industrial practice, require no further mention here. Since ocular injuries caused by explosives during demonstrations or through careless handling are similar to those occurring in combat, they are included.

Shell fragments caused 163 cases, or 54 percent, while bullets produced 34 cases of ocular injury, or 11 percent (see table 1). Rohrschneider,⁸ in his report on the eye casualties in the German army, submitted figures surprisingly similar to mine, namely, 56 percent of the injuries were caused by shells and 11 percent by bullets.

Ocular war wounds may be classified as follows (see table 2):

TABLE 1
WAR IMPLEMENTS PRODUCING OCULAR INJURIES
AND PROPORTION OF EYE INJURIES TO
OTHER INJURIES

Cause of Injury	Injuries to Eyes Only*	Injuries to Eyes, Body, and/or Extremities	Total
Shell fragment	86	77	163
Grenade fragments	10	5	15
Mine fragments	5	18	23
Blast	6	4	10
Shell fragments and blast	—	1	1
Grenade fragments and blast	1	—	1
Small arms fire	26	8	34
Explosions	5	5	10
Vehicles	3	4	7
Planes	2	—	2
Flying particles (glass, rock, debris, sand, etc.)	18	2	20
Sharp instruments	3	—	3
Blunt instruments	7	—	7
Burns	—	3	3
Fall	1	—	1
Total	173	127	300

* In 52 soldiers the injuries were bilateral.

1. Injuries caused by air blasts or burns.

2. Concussion waves reaching the eye through the tissues caused by direct impact upon adjacent structure or, less frequently, a more distant point.

3. Direct impact of a missile upon the eyeball.

TABLE 2
CAUSES OF INJURY IN 300 CONSECUTIVE OCULAR WAR CASUALTIES

Type of Injury	Number	Type Total	Total
I. Blast injuries			13
II. Indirect injuries			40
III. Direct injuries			
(a) Nonpenetrating injuries to eyeball		54	
(b) Penetrating injuries to eyeball			
1. Avulsions, ruptures, lacerations requiring immediate enucleation	104		
2. Penetrating injuries with retained foreign body	65		
3. Penetrating injuries without retained foreign body	37	206	
(c) Direct injuries to lids, extraocular muscles, orbit		30	290
IV. Burns of eyeball and lids			9
Total			352*

* In 52 cases the injuries were bilateral.

BLAST INJURY TO THE EYE

Injury to the eye by shells, grenades, or mines is usually due to the effect of fragmentation; however, severe ocular trauma can also be caused by an explosive force. A simple ocular blast injury shows no trace of a foreign body. Frequently, however, dust, débris, and other particles are driven into the eye by the blast. In such cases, it is difficult or impossible to distinguish between the damage caused by the blast and that caused by the flying particles.

Campbell⁹ describes the blast due to bomb explosion as a sudden compression and expansion of the atmosphere. The eye and ear are particularly vulnerable because of the exposed position of the eye and the physiologic adaptability of the ear to receive pressure. Bonnet¹⁰ believes that the injury is produced by the shock of the advancing air wave generated by the explosion. Young¹¹ explains the damage following blast injuries as due to the sudden increased pressure, which may rise as high as several atmospheres. This pressure is applied to all the surfaces of the body. There is no unanimity of opinion regarding the incidence of blast injuries to the eye. Zuckerman¹² doubts that blasts are a common cause of ocular injuries and gives as a reason that if an individual were close enough to an explosion to receive ocular damage from the blast, his injuries would be fatal.



Fig. 1 (Bellows). Bilateral iridodialysis caused by an explosive blast.

Further, he has found that most individuals exposed to high blast pressure fail to demonstrate ocular injuries.

On the other hand, Wiener¹³ writes that rupture of the choroid without even a bruise of the external eye or lids results not uncommonly from explosive forces. He describes a case of aneurism of the lateral sinus following an explosion. Vail² also found that blast is a frequent cause of ocular injuries (fig. 1).

These changes have been observed in blast injuries: Chemosis; hemorrhage leading to proptosis and optic atrophy; intraocular hemorrhage resulting from iridodialysis or the rupture of a retinal vessel; choroidal rupture and retinal hemorrhage, and acute iridocyclitis with secondary glaucoma.

In the 300 cases in this report there

TABLE 3

THE MAIN OCULAR LESIONS AND RESULTING VISUAL ACUITY IN 13 CASES OF BLAST INJURY

	Below 20/200	20/200 to 20/40	20/30 or Better	Total
Optic-nerve atrophy	2	—	—	2
Choroidal and retinal lesions	2	—	—	2
Intraocular hemorrhage or vitreous opacity	1	1	—	2
Changes in the lens	—	2	—	2
Changes in the iris and pupil	—	1	3	4
Extraocular muscle paralysis	—	—	1	1
Total	5	4	4	13



Fig. 2 (Bellows). Airplane crash and fire caused burns of face, lids, and eyeballs.

were 13 soldiers who suffered from severe ocular trauma due to nearby explosions. Only those patients exposed to a blast, in whom there were no apparent injuries by impact or penetration of a foreign body and yet who showed serious ocular pathologic conditions, were con-

sidered as blast injuries. Table 3 shows the chief ocular lesions and resulting visual acuity following blast injuries to the eye.

THERMAL INJURIES

There were three soldiers in this group who suffered from burns. Gasoline fire caused the burns of two of the men. The third was injured when his plane crashed and caught fire.

The lids were markedly affected and corneal opacities were present in all three (fig. 2).

INDIRECT OCULAR WAR INJURIES

This type of injury generally results from the enormous kinetic energy of a rapidly moving missile striking tissues in the vicinity of the eyeball. Powerful concussion waves produced by the projectile cause severe ocular lesions. Thus, a rapidly moving projectile passing through the orbit without striking the globe may produce a rupture of the eyeball opposite the point of impact. For example, a projectile penetrating the retrobulbar region may give rise to a rupture of the cornea, and one passing lateral to the globe may



Fig. 3 (Bellows). Bullet in retrobulbar region caused choroidal rupture with atrophic chorioretinitis. Enophthalmos is present.

cause rupture near the opposite equator. Kaminskaya¹⁴ finds that indirect ocular injuries occur most commonly following injuries of the lower outer orbital margin and the zygomatic arch. Ocular lesions resulting from injuries of the inner orbital wall and nose are less frequent.

The lesions resulting from this form of indirect injury involve the posterior segment more often than the anterior. The explanation for this occurrence, according to Lagrange,¹⁵ is that the macular area is the most fragile and -vulnerable region and that the concussion waves toss the eyeball about within the orbit, causing traction on the optic nerve to produce posterior lesions (fig. 3).

Symptoms naturally vary with the extent, location, and nature of the lesions. They may appear immediately or may not become evident for days or even months. Intraocular hemorrhages are frequently present although peripapillary and macular hemorrhages are more common. Kaminskaya¹⁴ believes that the injury which produces subluxation of the lens in the anterior segment causes, in the posterior segment, a reverse wave which separates the vitreous and the retina. This produces a vacuum which, in the presence of the alterations in the vessels (spasm followed by dilatation and increased permeability), leads to hemorrhages. Edema of the disc and retina with choroidal rupture are frequently encountered (fig. 4). Lister¹⁶ terms "grossly concussed fundus" a lesion which in the early stages is characterized by hemorrhagic clouds, white particles which represent patches of coagulation necrosis from rupture of choroidal and retinal vessels. These patches change gradually into fibrous tissue. Later, secondary lesions appear, consisting chiefly of atrophic and proliferating chorioretinitis.

Purtscher¹⁷ was the first to call attention to an interesting form of indirect

ocular injury which is now known as "traumatic liporrhagic retinalis." Cases have been reported resulting from fracture of the vertebrae or compression injuries to the thorax and abdomen. Purtscher¹⁷ explains the pathogenesis of the retinal changes as follows: Compression of the longitudinal axis of the spine due



Fig. 4 (Bellows). Shell missile injury to face producing ipsilateral choroidal rupture.

to head injury increases the cranial pressure; the pressure is transmitted along the intervaginal space and then into the nerve head; this results in an extravasation of fluid into the retinal spaces. The more recent authors attribute the changes to fat emboli. Friedenwald,¹⁸ Urbanek,¹⁹ Loewenstein,²⁰ Verhoeff,²¹ and Spaeth²² think the retinal changes are due to a generalized diffusion of fat droplets in the fundus. Therefore, the term "traumatic liporrhagic retinalis" has been applied to this condition. The usual ophthalmoscopic findings consist of hemorrhages, exudate, and edema with destruction of the arteries and dilation of the veins.

Finally, ocular alterations occur indi-



Fig. 5 (Bellows). Horner's syndrome following a wound in the supraclavicular region.



Fig. 6 (Bellows). Paralysis of the orbicularis oculi following shell injury in the parotid region.



Fig. 7 (Bellows). Pulsating exophthalmos resulting from shell injury. A, Point of entrance. B, Point of exit.

rectly as a result of injuries to nerves or blood vessels supplying the globe and its adnexa. Thus, Horner's syndrome follows injury in any portions of the sympathetic such as in wounds of the neck (fig. 5). Paralysis of the orbicularis oculi results from injury to the facial nerve (fig. 6). Pulsating exophthalmus may follow an injury which ruptures the internal carotid artery in the sinus cavernosus (fig. 7).

In the 40 cases of ocular alterations produced by indirect injuries, the chief ocular lesions were intraocular hemorrhage and changes in the vitreous, choroid, retina, and optic nerve (see table 4).

DIRECT OR CONTACT OCULAR INJURIES

A direct or contact injury is produced by the impact of a missile upon the eyeball. Contusion, perforation, penetration (with or without retention of a foreign body), laceration, or avulsion are forms of direct or contact ocular injuries that were observed. Frequently secondary missiles, such as debris, sand, gravel, wood, or glass, set in motion by the explosion, cause far more damage than the primary missile (fig. 8).

If the impact of the missile is of insufficient force to cause perforation, penetration, or rupture, it produces signs and symptoms of a contusion injury. When



Fig. 8 (Bellows). Injury to face, lids, and eyes produced by secondary missiles (debris and sand).

the force is adequate, the missile perforates or penetrates the globe or causes a rupture of the eyeball. At times the missile carries away part or all of the eyeball, thus producing a partial or total avulsion of the globe.

Bullets produce more severe ocular injuries than do fragments of shells, mines,

TABLE 4

PRINCIPAL OCULAR CHANGES WITH RESULTING VISUAL ACUITY FOLLOWING CONCUSSION INJURIES

	Enuclea- tion	Nil	Below 20/200	20/200 to 20/40	20/30 or Better	Total
Rupture of globe	1	—	—	—	—	1
Phthisis bulbi	—	—	1	—	—	1
Atrophy or avulsion of optic nerve	—	5	3	2	—	10
Ophthalmoplegia	—	—	—	1	—	1
Choroidal and retinal lesions	—	—	6	2	5	13
Intraocular hemorrhage or vitreous opacity	—	—	1	3	1	5
Lens changes	—	—	1	1	—	2
Dilatation of the pupil	—	—	—	—	5	5
Horner's syndrome	—	—	—	—	1	1
Muscle paralysis	—	—	—	—	1	1
Total	1	5	12	9	13	40

or grenades. Thus, in World War I, according to Mills,²³ not more than 25 to 30 percent of ocular casualties caused by bullets were saved, while about 60 percent of shell injuries were saved. In the 198 direct eye injuries by shells, grenades, and mines in the series reported in this paper, enucleation was necessary in 105, or 53 percent. In 25 cases of direct injury by bullets, 16, or 64 percent of the eyes were lost.

The disorganization of the globe when struck directly by a velocity projectile is caused by the propagation of the velocity of the projectile to the globe with its incompressible fluids. Mills states that "velocities being equal, the smaller the eye, the greater the destruction." Harvey and others²⁴ have recently shown that when a velocity missile strikes soft tissues it results in a series of phenomena comparable to that observed in water or a gel. The liquid is first compressed. This area of compression precedes the missile as a shock wave. The missile forces the media aside as well as forward, thus producing a conical cavity. In the tissues, the cavity fills with blood and tissue debris. Blood extravasates into the tissue spaces. In the region away from the cavity the chief damage is the rupture of the capillaries.

NONPENETRATING OR CONTUSION INJURIES

Contusion injuries caused by the impact of missiles vary from a slight corneal abrasion or foreign body embedment in the cornea, conjunctiva, or sclera to rupture of the globe. Contusion injuries are produced chiefly by a nonpenetrating direct or glancing blow by a missile. Markelova²⁵ reports that 58 percent of ocular military injuries are nonpenetrating. Under the term "the traumatic syndrome of the anterior segment of the eye," Frankel²⁶ groups the symptoms and findings

of contusion injury as follows: Hyphema, deep anterior chamber; changes in the iris consisting of tears, iridodiolysis, rupture of the pupillary margin, iridodonesis; pupillary alterations, mydriasis or deformity; dislocation and cataract formation of the lens. Leplat,²⁷ in an experimental and clinical study of contusion injuries, reports that following a contusion there is a variation in ocular tension, an increased protein content in the aqueous humor, spasmodic miosis, and congestion of ciliary and conjunctival vessels.

Hypotony is a frequently occurring symptom. DeSchweinitz²⁸ warns against the common conception that this finding necessarily signifies a perforating wound. Collins²⁹ believes the decreased tension is due to escape of intraocular fluid through expanded exit channels or to arrest of secretion because of paresis of intraocular nerves. According to this author, hypotony causes some of the conditions ordinarily ascribed to trauma. Striate keratitis and pigmentary changes in the choroid and retina are caused by the wrinkling of the elastic lamina of the cornea and choroid, respectively. Frequently overlooked, according to Kilgore,³⁰ are the alterations in the ciliary body after contusion of the globe. Edema, round-cell infiltration, pigment migration, and scar-tissue formation are observed in the ciliary body after several days. These changes explain some of the permanent visual disturbances following a blow of moderate degrees. The lesions resulting from contusion injuries in warfare differ from those seen in civilian life because the velocity of the striking force which causes war injuries is so much greater. Twenty-seven individuals out of the 300 cases received ocular injury by contusion. The following lesions were observed in this group. In 11 eyes, the chief lesion was in the posterior seg-



Fig. 9 (Bellows). Contusion injury causing changes in pupil and lens.



Fig. 10 (Bellows). Corneal scar following a contusion.

ment—six eyes showed chorioretinitis; one, macular hole; one, choroidal rupture; two, optic atrophy; and one, avulsion of the optic nerve. There were six cataracts; in one eye, the cataractous lens was dislocated (fig. 9). In four eyes, the main alteration was in the cornea, resulting in opacities (fig. 10). The visual acuity resulting from contusion injuries is shown in Table 5.

PENETRATING INJURIES OF THE GLOBE

Penetrating injuries are more likely to involve the cornea than the sclera. Savin and others³¹ found that of 36 patients all but five had corneal or corneoscleral injuries. According to Verhoeff,³² the flying missiles strike the pupillary area less often than other parts of the cornea because the former makes up only a small part of the total corneal surface.

The lesions produced by a missile which perforates the ocular coats or penetrates



Fig. 11 (Bellows). Penetrating injury of the globe by a high-velocity-shell particle.

deeply into the globe are usually severe (fig. 11). The more serious lesions characterized by the collapse of the globe are considered with lacerations and ruptures of the eyeball. The changes resulting

TABLE 5
COMPLICATIONS AND VISUAL ACUITY FOLLOWING CONTUSION OF EYEBALL

	Nil	Below 20/200	20/200 to 20/40	20/30 or Better	Total
Optic-nerve lesions	1	2	—	—	3
Choroidal and retinal lesions	—	4	1	3	8
Intraocular hemorrhages	1	4	1	—	6
Lens changes	—	3	1	2	6
Corneal opacities	—	—	1	3	4
Total	2	13	4	8	27

from a penetrating ocular injury vary according to the size and velocity of the traumatizing agent, the depth of penetration and the site of the wound.

With the exception of very small wounds, a corneal perforation causes an outrush of aqueous, which carries the iris forward. Frequently the iris is incarcerated in the corneal wound or may actually prolapse out of the wound. The lens very often becomes opaque. Hemorrhage either occurs in the track of the missile or is more widespread within the

jects into the vitreous. Some darkly pigmented areas may cover part of the mass.

Corneoscleral penetrations offer the gravest prognosis, for in these cases both the anterior and vitreous chambers are opened with subsequent loss of aqueous and vitreous and exposure to infection. Prolapse of iris, ciliary body, and vitreous are common complications. Subluxation of the lens follows injury to the zonule. When the injury is in the ciliary region, there is a distinct danger of

TABLE 6

COMPLICATIONS AND VISUAL ACUITY RESULTING FROM PENETRATING INJURIES
(WITHOUT RETENTION OF FOREIGN BODY)*

	Enuclea- tion	Nil	Below 20/200	20/200 to 20/40	20/30 or Better	Total
Intraocular hemorrhage and vitreous opacities	6	3	5	1	1	16
Endophthalmitis	2	1	—	—	—	3
Phthisis bulbi	6	4	—	—	—	10
Adherent leukoma	1	—	1	1	1	4
Corneal opacities	1	—	5	1	1	8
Iris lesions	3	1	6	—	1	11
Pupillary lesions	—	1	—	—	—	1
Cataract	2	—	8	1	2	13
Lens dislocation	3	1	2	—	—	6
Chorioretinitis	—	—	2	3	1	6
Choroidal rupture	—	—	1	—	—	1
Retinal detachment	—	—	1	—	1	2
Retinal hemorrhage	—	1	2	—	1	4
Sympathetic ophthalmia	1	—	—	—	—	1
Total	25	12	33	7	9	86

* Some globes showed two or more serious lesions.

globe. Choroidal and optic-nerve lesions are produced either because the penetrating agent strikes these structures directly or because the structures undergo early or late changes due to edema, inflammation, hemorrhage, or infection. Traumatic proliferative choroiditis is a condition frequently observed in wartime. Michaelson and Kraus³³ observed such lesions in 6 of 7 cases in which a double penetrating injury was incurred. If the media is clear, a white mass is observed in a choroidoretinal atrophic area. The mass appears solid and pro-

sympathetic ophthalmia, particularly if prolapse of the iris and ciliary body is present.

There were 206 eyes with penetrating injuries in the 300 cases in this series. The injuries in 104 of these were so severe that enucleation of the globe was required shortly after the injury. This group is considered with avulsions, ruptures, and lacerations of the eyeball. Furthermore, there were 65 eyes in which the penetrating injuries were complicated by retained foreign bodies; these are considered in the section of intraocular

foreign bodies. There were 37 eyes with a penetrating injury in which the foreign bodies were not retained. Table 6 presents the ocular lesions observed in the latter cases.

RUPTURE OF THE EYEBALL

Rupture of the globe, including laceration and partial avulsion of the eyeball, produces the clinical features of a collapsed and disorganized eyeball. If observed early, there is a marked swelling of the lids, severe chemosis, and limitation of motion. The latter is due to retrobulbar hemorrhage. Lister¹⁶ distinguishes between rupture of the globe resulting from a blow by a slowly moving body, which strikes the eye directly, and rupture arising from an injury produced by a missile travelling at a great velocity through the orbit. In the former instance, the break occurs "in the equator around the line of impact, at a point where the globe is least supported;" in the latter type, the force is transmitted to the globe and causes rupture, usually at a point of contrecoup. Finally, rupture of the eyeball may be caused by a missile passing through it. If the projectile is large and is travelling at a high speed, it may cause an extensive laceration of the globe or

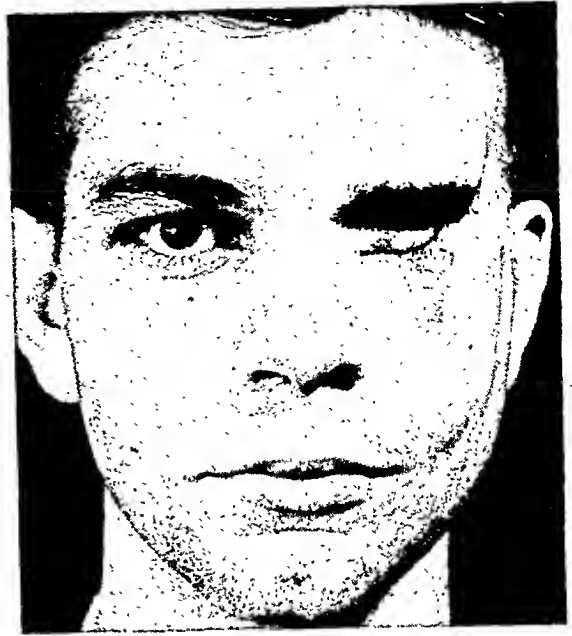


Fig. 12 (Bellows). Fracture of orbit, rupture of eyeball, and laceration of lids and surrounding soft tissues caused by a high-velocity-shell fragment.

even avulsion of the eyeball. There were 105 eyes belonging to this group of trauma, all of which required primary enucleation or early secondary enucleation. In all but 36, there were wounds of the surrounding soft tissues, fracture of the orbit, or intraorbital foreign bodies (see table 7 and fig. 12).

INTRAOCULAR FOREIGN BODIES

Penetrating injuries with a foreign body retained within the globe form both a large and an important proportion of ocular casualties. Dansey-Browning³⁴ reports 67 cases of intraocular foreign bodies in a series of 514 ophthalmic battle casualties.

Stallard³⁵ reported 105 cases of intraocular foreign bodies and found that the right eye was injured in 41 cases, the left in 34, and both eyes in 30. As in all types of penetrating injuries to the eyeball, the cornea is the most frequent site for the entrance of the foreign body. In 56 of Stallard's cases, the foreign

TABLE 7

ASSOCIATED INJURIES AND COMPLICATIONS ACCOMPANYING RUPTURE, AVULSION, OR SEVERE LACERATIONS OF EYEBALL

Complication	Number
Lid laceration	28
Lid laceration and orbital fracture	18
Lid laceration and orbital cellulitis	2
Lid laceration and burn of lids	1
Lid injuries associated with orbital fracture	
and retained intraorbital foreign body	4
Lid laceration and dacryocystitis	1
Orbital foreign body alone	4
Orbital fracture alone	10
Orbital fracture with dacryocystitis	1
No injuries to orbit or adnexa	36
Total	105

body entered through the cornea; in 42 through the sclera; and in three cases the foreign bodies were multiple and entered the globe through the cornea and sclera. Trevor-Roper³⁶ found the site of entrance to be through the cornea in 100 eyes, across the limbus in 11, and through the sclera in 15. Scott and Michaelson³⁷ stated that 76 out of 301 ocular casualties suffered from intraocular foreign bodies. There were two bilateral cases. The wound of entry was through the cornea in 37 percent; the limbus in 33 percent; the sclera in 26 percent; and undetermined in 4 percent.

Intraocular foreign bodies were found in 65 eyeballs in this group of 300 soldiers with a total of 352 eye injuries. The left eye was involved in 32 cases, the right eye in 29, and both eyes in two. The reason for the small number of bilateral involvements observed at this hospital is that soldiers with bilateral eye injuries with visual acuity in the better eye of 20/200 or less were sent to other installations. Those eyes with foreign bodies which were so badly disorganized as to require primary enucleation are not included here.

The intraocular foreign bodies encountered in military ophthalmology differ from those observed in civilian or industrial practice in that bilateral involvement is more frequent and that the particles are usually smaller, multiple, and nonmagnetic or weakly magnetic. In contrast to the smooth surfaces of chips from punches, hammers, chisels, and so forth, which cause a great number of industrial cases, fragments from projectiles are generally irregularly shaped, with ragged edges and rough surfaces.

Shell and bomb fragments are generally magnetic but of low degree, while fragmentations of grenades, booby traps, and land mines are poorly magnetic or not at all. There is a wide divergence

of opinion as to the proportion of magnetic to nonmagnetic foreign bodies. Comparing 125 cases of intraocular foreign bodies due to war injury with as many case of industrial injuries, Pokrowsky³⁸ found that only 45 percent of the former group were magnetic as compared to 85 per cent in the latter group. In 78 cases reported by Gasteiger and Schmidt,³⁹ they found only four that responded to the magnet, and of these, two were industrial war injuries and not field injuries. Stallard,³² in 105 cases of intraocular foreign bodies, found 66 were nonmagnetic and 39 were magnetic, of which the majority were magnetic to only a slight degree. Wiener,¹³ too, remarks upon the extremely low incidence of magnetic intraocular foreign bodies encountered in World War II.

The intraocular foreign bodies are nearly always of small size. The reason for this is that the larger projectile, because of its high velocity, disorganizes the eyeball to such a degree that immediate enucleation is required. Stallard³² found the majority of foreign bodies measured 2×3 mm., or less. The foreign bodies were measured in 19 eyes in the series reported herein, and it was found that 16 were 2 mm. or less in the largest dimension. The three largest particles were 1×3 , 2×4 , and 5×6 mm.

The clinical features produced by intraocular foreign bodies depend upon such factors as the number, size, and location of the foreign body; the presence of intraocular hemorrhage; infection or prolapse of vitreous, lens, or uveal tissue; and alterations in the media, fundus, and optic nerve. Another important factor is whether the foreign body is well tolerated or whether it calls forth an inflammatory reaction. Depending upon these conditions, the lesion produced by a foreign body may be very slight or so extensive as to require enu-

cleation of the eyeball. If the wound is recent, examination may reveal the point of entrance. Slitlamp examination in some instances reveals the path of the foreign body and the place of lodgement. A small perforation through the sclera frequently escapes detection. A foreign body lying within 3 mm. from the center of the cornea is considered to be anterior to the lens; if it is situated between 3 and 7 mm., it lies within the lens; between 7 and 24 mm., it lies within the vitreous humor.

If the eye is preserved and the foreign body is retained, other symptoms may arise, depending upon the nature of the foreign body. Particles rich in iron differ from other intraocular foreign bodies in that they are magnetic and are capable of producing siderosis bulbi. Since iron and iron-containing foreign bodies are usually removed early, siderosis is seldom observed. In this series of 65 cases of intraocular foreign bodies, only three eyeballs showed siderosis bulbi. Copper also deserves special mention since it frequently produces either severe purulent reaction or chalcosis bulbi. Chalcosis bulbi was present in two soldiers. In one, a nonbattle injury, the lesion was bilateral; in the other, only one eyeball was involved. Mickle⁴⁰ reports that aluminum, which produces an abscess in the skin, is paradoxically well tolerated in the eye. Wiener,⁴¹ agreeing with this observation, recommends that no attempt be made to remove intraocular foreign bodies of aluminum. Minute particles of rock, glass, and lead are well tolerated by the eye.

Table 8 shows the most important pathologic lesions resulting from 65 cases of intraocular foreign bodies. Some eyes showed multiple severe lesions. The most common causes for the loss of visual acuity in eyes which have been injured by an intraocular foreign body are cataract; corneal opacities, including adher-

ent leukoma, intraocular hemorrhage, and vitreous opacities; phthisis bulbi; and lesions in the iris, retina, and choroid.

A factor of prime importance in the proper management of intraocular foreign bodies is accurate localization. Fortunately, most intraocular foreign bodies

TABLE 8

THE CHIEF PATHOLOGIC LESIONS OBSERVED IN 65 CASES OF INTRAOCULAR FOREIGN BODIES*

Lesions	Number
Intraocular hemorrhages	17
Vitreous opacities	7
Endophthalmitis	4
Phthisis bulbi	13
Corneal opacities	18
Adherent leukoma	9
Iris and pupillary lesions	20
Cataract	30
Chorioretinitis (atrophic or proliferative)	11
Choroidal rupture	3
Retinal detachment	8
Macular hole	1
Avulsion of optic nerve	1
Chalcosis bulbi	2
Siderosis bulbi	3
Sympathetic ophthalmia	1

* Some eyes showed two or more serious lesions.

resulting from war injuries cast a shadow on X-ray films. The two chief exceptions are the secondary missiles, stone and glass, and even these are detectable by special methods such as Vogt's⁴¹ bone-free technique. Bone-free roentgenograms as recommended by Vogt are of particular value if the foreign body lies in the anterior 8 to 12 mm. of the globe. Since the apex of the cornea or the plane of the corneal limbus is used as a point of reference, it is sometimes difficult to determine if a foreign body near the posterior pole lies in or out of the eyeball. Moreover, it is well-known that refractive errors and variations in the size of the eyeball make for the possibility of error. In such cases the injection of air (Spackman⁴²) or oxygen (Scheie and Hodes⁴³) into Tenon's capsule gives valuable information.

In some cases, the Berman Metal Locator was of considerable value in localizing the intraocular foreign bodies. Since the instrument yields a response only if the probe is very near to a magnetic particle, a negative reaction does not preclude the possibility of the presence of a non-magnetic foreign body, for the magnetic foreign body may be deep within the globe.

The posterior surgical approach was employed in nearly all instances. The great advantage of this method, an advantage that outweighs all possible disadvantages, is the fact that it places the magnet as near the foreign body as possible. This was particularly desirable because the foreign bodies were frequently poorly magnetic. The sclerotomy wound was always ringed with diathermy applications as a safeguard against retinal detachment.

In the series of the 65 eyes with intraocular foreign bodies herein reported, 29 were magnetic and were removed. In four eyes however, one or more other particles remained within the globe, indicating that a combination of magnetic and non-magnetic foreign bodies existed in the same eyeball. In 36 eyes, the foreign body did not respond to one or more attempts at removal with the magnet and were considered nonmagnetic. In some instances, subsequent enucleation of the eye confirmed the nonmagnetic nature of the foreign bodies.

The following summarizes the results: In 20 cases, the eye was finally enucleated; in four, the eye, although preserved, was totally blind; in 22, visual acuity was less than 20/200; in 13, visual acuity was between 20/200 and 20/40; in six, visual acuity was 20/30 or better.

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NOTES, CASES, INSTRUMENTS

PRESSURE EFFECTS IN CONTACT LENSES

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The first contact lenses, the Müller lenses, were made by a glass-blowing process, similar to that for making artificial eyes. Neither the corneal section nor the scleral section of these lenses was made with any degree of scientific accuracy. In spite of this, however, the occasional successes which these lenses afforded, especially in cases of conical cornea, spurred on further research. The next step was completely opposite, the Zeiss glass ground lenses in which both the corneal section and the scleral section were ground with scientific precision.

The corneal section perfected by precision grinding more than 30 years ago has not been improved upon except that the corneal section is now made of plastic. The scleral section, however, ground as it was on spherical tools gave but a limited number of successful fittings. Subsequent improvements in contact lenses concerned themselves chiefly with perfecting the scleral portion so as to make the lens more comfortable to the wearer.

As the spherically ground scleral section did not prove satisfactory in most cases, a toric system of scleral curves was designed. These yielded a greater number of successful fittings than the spherical curves had, but they still fell far short of solving the problem of a comfortable scleral fit.

The idea was then conceived that if the scleral portion of the lens was made from a mold or impression of the eye it would give a good comfortable fit. The idea seems reasonable, but in practice has not worked out. Most of the lenses made

from a mold exert too much pressure on the eye and a great many are uncomfortable. This occurs in spite of numerous adjustments, stretching over months and months, during which the lenses are ground out, tightened, loosened, and so forth.

In the search for a better scleral section, the idea was conceived to make the bearing surface of the scleral section a portion of a cone. A lens was designed so that the bearing, conic section touched the sclera on a tangent, resting only on a narrow rim of 1 to 2 mm. This has proved very satisfactory and caused a revision of one of the cardinal principles which governed contact-lens fitting.

From the earliest days of contact-lens fitting, it has been assumed that the larger the bearing surface of the lens on the eye the more comfortable the lens would be. The idea was that the larger bearing surface would distribute the pressure over a larger area of the eye and thus produce minimum pressure everywhere.

But the idea, plausible as it sounds, is based on a fallacy, as the following illustration will show. If we take a 20-pound weight and place it on one square foot of a table, 20 square feet in area, this square foot of the table will be under a pressure of 20 pounds, while the rest of the table will be under no pressure. The table will suffer some distortion because of the uneven pressure on it. If we now break up the 20 pound weight into 20 parts and place each pound on one square foot of the table, the pressure will be evenly distributed and the table will suffer no distortion. This is perfectly true of gravity pressure.

The pressure of a contact lens on the eye, however, is not gravity pressure. It is an adherent force or adherent pressure,

for want of a better term. Such adherent pressure interferes least with the functions of the eye when it is limited to a small area. In other words, the principle is reversed. The smaller the bearing surface exerting this adherent pressure, the more comfortable the lens is on the eye. This principle is utilized in the tangent-cone contact lens. The bearing surface of the scleral portion is part of a cone which rests tangentially to the eyeball. It is adherent only over a narrow rim of 1 to 2 mm.

The clue to this principle of fitting came from observations made on impression molded lenses. It was found that, when these lenses were adjusted so as to fit the sclera "like a glove," they were more uncomfortable than when they were adjusted so as to have a smaller bearing surface more or less tangential to the eyeball. Following up this clue led to the design of the tangent-cone lens.

37 West 97th Street (25).

PLASTIC VISUAL TEST PLATES

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AND

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Exact measurement of visual acuity is seldom necessary in routine refraction. An approximation is usually all that is needed, since it makes little practical difference whether an individual's uncorrected vision is 20/200 or 20/100, and since the refractionist's ultimate aim is to obtain the best possible corrected vision regardless of which line on the chart this may be.

There are occasions, however, on which it is of considerable importance to have as nearly exact records of visual acuity as is possible to obtain. In the Armed Forces,

for instance, a difference of one line on a test chart may alter a man's physical classification or may disqualify him for a desirable position. In civil life a somewhat comparable situation may arise in compensation cases. Again, in an orthoptic clinic, careful follow-up of cases undergoing occlusion necessitates an accurate and consistently reproducible method of determining vision.

A particular problem is that of individuals who profess to better uncorrected vision than would be expected by the degree of refractive error which they possess. These are usually candidates for positions or schools which require a high standard of visual acuity. A determined patient, aware of poor vision, will often go to extraordinary steps to pass these tests. Memorization of charts and other stratagems are well-known. The usual types of wall charts are of course easily memorized. Projecting instruments lend themselves less readily to memorization in the lines which represent high visual acuity, but there is little chance for the examiner to vary or alternate letters in the 20/100 to 20/400 lines, a region in which critical evaluation may be all important.

As has been pointed out repeatedly, most of the charts now in general use do not remove the factor of recognition inherent where letters or numbers are employed. The need for standardization of test charts has also been emphasized. Most observers¹⁻³ favor some modification of the Landolt ring test, this being a figure which meets the criteria of Snellen in all meridians, including the critical detail of one minute of arc, as well as the gross overall figure of five minutes of arc. The factor of recognition does not enter as it does with letters. It has been stated that the break in the Landolt ring might be detected by its increased luminosity before its form could be actually

distinguished. Nevertheless, its advantages as compared to the other test symbols now in use would appear to outweigh its disadvantages. Fink² has recently described individual test plates printed on round pieces of cardboard and viewed in reflected light at an illumination of 15 foot-candles. Such printed

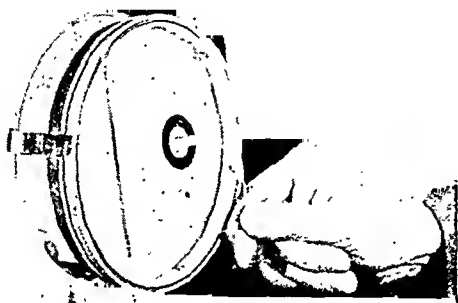


Fig. 1 (DeVoe and Dietz). Plastic visual test plate in use.*

cards used by the same examiner under the same conditions should produce excellent results. When many copies of any cards are printed, inevitable variations appear in the reflection factor of the background, letter itself, finish of its surface, and type of ink. When the cards become dirty or worn with use, further inaccuracies may appear.

In order to obtain a test which would be practical, accurate, easily adaptable to varying surroundings, and with the par-

* A modification of these plates may be obtained from A. Haustetter, Inc., 2 East 45th Street, New York 17.

ticular factor of being unlearnable, the following plates were devised using both the illiterate E and the Landolt single-break ring (fig. 1).

A diffusion screen was constructed of two layers of 10/1,000-inch double-matte plastacele in such a manner as to readily clamp upon a reflector shield of a standard gooseneck desk lamp. This, when used in conjunction with a 15-watt frosted bulb, has given evenly diffused lighting of about 25 foot-candles in intensity.

Test figures were cut from 10/1,000-inch vinyl copolymer (vinyl chloride and vinyl acetate). These figures were then laminated to $\frac{1}{8} \times 4 \times 4$ -inch lucite plates by use of a laminating press. Lamination was effected at 140° C. for 30 seconds at 4,000 lbs. pressure, and the pressure then increased to 6,000 lbs. for 15 seconds. After release of the pressure, the lucite plates were pulled off the metal plates while hot and allowed to cool on a cold metal pate. The Snellen value of the figures may be conveniently scribed on a corner of the lucite plates by using a metal trylon stylus in a lettering device. Any desired figures can be adapted to this process.

SUMMARY

The visual test plates herein described have the following advantages:

1. They present clear, accurate images under constant conditions of illumination.
 2. They are unbreakable and will withstand use without loss of efficiency.
 3. They are unlearnable.
- 635 West 165th Street (32).

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CILIARY DILATION AND VITREOUS RECESSION IN CATARACT EXTRACTION

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After a review of the literature relative to the mechanism of accommodation and a limited amount of experimentation¹ on that subject, it appeared that some of this information might be useful in cataract surgery. During parasympathetic stimulation, the ciliary processes have been shown to move toward the lens and the anterior surface of the vitreous to bulge forward and axialward. There resulted a narrowing of the interval between the lens equator and the ciliary processes. Under the influence of parasympathetic depressants, the interval increased and the anterior vitreous moved posteriorly and centrifugally. It was apparent that parasympathetic depressants enhanced the possibility of a successful cataract extraction by their indirect influence on the vitreous and zonule.

In view of the reports of Cogan² and others, it was accepted that the sympathetic nervous system had a role in accommodation. It seemed logical that sympathetic stimulation should augment the effects of parasympathetic depression; that is, further widen the zone between the lens equator and the ciliary processes and produce added recession of the anterior vitreous.

Neosynephrine hydrochloride* (10 percent) and scopolamine hydrobromide (0.2 percent) were instilled in 80 eyes

preceding cataract extraction. One hour before surgery two drops of scopolamine were instilled on the cornea; 30 minutes later two drops of 0.5-percent pontocaine hydrochloride were instilled, and this was followed in two minutes by the instillation of one drop of neosynephrine. In the operating room, two minutes after the first instillation of 5-percent cocaine hydrochloride, one drop of neosynephrine was again placed on the cornea. Approximately 15 minutes later, local anesthesia was completed and the operation was begun. An O'Brien akinesia and corneoscleral sutures were used in all cases. Six extracapsular extractions were done. The intracapsular method was attempted in the remainder but the lens capsule ruptured in six. In no case was vitreous lost. There was no tendency for the iris to bulge and in many cases its pupillary portion was recessed. The pressure required at the limbus to rupture the zonule was less than ordinarily needed. No patient complained of undesirable systemic reactions.

It is not amazing that there was no loss of vitreous in 80 consecutive cataract extractions, but in no case was vitreous protrusion threatened. The use of scopolamine and neosynephrine appeared to provide increased safety in cataract surgery. The drugs gave maximum pupillary dilation by relaxing the iris sphincter and stimulating the dilator. They widened the interval between the lens equator and the ciliary processes, thus increasing the tension of the suspensory fibers of the zonule. These changes facilitated the manipulation for zonular rupture. The anterior vitreous was actively recessed and a safeguard against its extrusion provided.

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* Neosynephrine hydrochloride solution (10 percent) supplied by Frederick Stearns and Company, Detroit, Michigan.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

March 4, 1946

DR. MAURICE L. WIESELTHIER, *presiding*

CHARTING OF DIPLOPIA AND MUSCLE ACTION

DR. JOSEPH PASCAL discussed the subject during the preliminary instruction period (Published in this Journal, 1946, volume 29, August, page 1001).

THE OBSERVATION AND CORRELATION OF SCIENTIFIC DATA

DR. ERNEST L. SCOTT said that it is common knowledge that the items of a sample vary among themselves. It is also common knowledge that samples from a given population will differ from each other not only in the value of the mean but in the amount of variation within the sample.

Since one is usually interested in evaluating the population from which the sample is drawn as well as the sample itself, it is desirable not only to describe the sample adequately but to be able to describe the population and so to be in a position to predict the characteristics of further samples drawn from that population. The theory of sampling makes all of this possible.

The fundamental mathematics involved in the theory of sampling need bother one no more than does the formula for his microscope objective. The use of probability paper makes difficult drafting unnecessary. No more complicated apparatus than a ruling pen and a straight edge are needed to display the characteristics of a sample fully in a chart. Given the

mean and standard deviation of an appropriate and adequate sample, one not only can describe that sample concisely but one also can predict the properties of further samples within stated limits, as well as the characteristics of the population from which the sample is taken. This implies the possibility of assigning a degree of probability that a single further item does or does not belong to the population; that is, whether the patient in the office is or is not normal with respect to the property being measured.

Since the description of a sample is mathematical, samples can be readily compared either by difference or by ratio, and the precision of the comparison can be stated. This makes for the convenience of the investigator in evaluating his data, and for the clarity and ease with which the report can be read. It also permits precise comparison of the work of different investigators who have reported their work in this form. The measures of variation will make conclusions more exact and will safeguard the reader against over-enthusiasm on the part of the author. Data treated systematically in this impersonal manner can hardly carry any tinge of bias.

If samples are to do all this satisfactorily, they must be both adequate and appropriate. Evidence is presented that when an appropriate sample approaches 50 items its statistics follow the requirements of the theory in a satisfactory manner.

The determination of appropriateness is more difficult. The sample must be homogeneous. The lack of homogeneity was illustrated in the early figures for CO₂ tension of the blood. The figures determined at sea level would not fit at high

altitudes. A method for homogenizing a sample was described.

Discussion. Dr. Percy L. Fridenberg said that Dr. Leo Burger observed symptoms in patients in the same age group (30 to 40 years), numbering over 100 cases, and tabulated them according to age, occupation, weight, and so forth. There was interference with the circulation of the lower extremities, and observation revealed thrombosis and obstruction of the blood vessels; that is, thrombo-angiitis obliterans. Ninety-five percent of these patients were tailors who sat with their legs crossed, smoked a great many cigarettes, and drank large quantities of tea. All of these symptoms can be considered as causative factors.

SYSTEMIC FINDINGS IN RETINITIS PIGMENTOSA

DR. ISADORE GIVNER and DR. MAURICE BRUGER said that a study of 14 patients with retinitis pigmentosa gave the following results and conclusions:

1. No abnormalities in pulse rate, blood pressure, or temperature were observed.

2. The serum cholesterol was within normal limits in 7 of 11 patients in whom this determination was made. In three, it was only slightly elevated.

3. The basal-metabolism rate was within normal limits in 8 of 12 patients. In four, the rate varied from 15 to 21 percent below the average normal.

4. Each of 11 patients had creatinuria. This series included eight males and three females.

5. The spinal-fluid pressure was increased in 3 of 12 patients, but most of the other readings bordered on the upper limit of normal rather than on the lower levels. In 3 of 12 patients, the total protein content of the spinal fluid was definitely increased. In the remainder, normal values were observed.

6. Liver damage was not demonstrable in any of the 12 patients investigated.

7. The fasting vitamin-C content of the plasma was reduced in 7 of 9 patients in whom this determination was carried out. The two patients with normal findings had been taking cevitic acid before the test was carried out. In seven patients, vitamin-A studies on the serum gave normal values.

8. In each of 11 cases, pupillography showed tonohaptic reactions and other evidences of diencephalic disorders.

9. Blood analysis for urea nitrogen retention and urine specific gravities after the administration of pitressin failed to reveal any measurable impairment in renal function in 13 patients.

10. Physical examinations including neurologic studies were essentially negative, except for the high incidence of high-arched palates and nerve deafness as revealed by audiometric tests. Seven of eight patients thus studied revealed impairment of hearing. Two patients were deaf mutes.

11. In two patients, microscopy failed to reveal any abnormalities in the capillaries of the finger bed.

Discussion. Dr. Otto Lowenstein found, in 1938, in collaboration with Franceschetti, the presence of tonohaptic pupillary reactions in retinitis pigmentosa and also in adiposogenital dystrophy, as well as in some chronic postencephalitic and catatonic conditions. Later, it was shown, experimentally and clinically, that tonohaptic pupillary reactions were due to lesions in the posterior (sympathetic) part of the hypothalamus and its connections to the midbrain, and that symptomatically they were due to a central weakness of the sympathetic. The significance became more evident in the light of experiments on the relations between endocrine glands and their autonomic control. When pituitary glands were im-

planted into pigeons or small mammals, or when antuitrin S was injected into human beings, increased parasympathetic activity resulted and could be shown pupillographically.

These facts, in combination with our knowledge of the melanophore-expanding hormones, may perhaps throw some light on the mechanism involved in the production of retinitis pigmentosa. Experimental work indicates the following schematic and tentative mechanism:

Inhibition of the sympathetic center, as indicated by tonohaptic pupillary reactions, causes a relative parasympathetic hyperactivity, stimulating pituitary action and resulting in, among others, the production of an increase of melanophore-expanding hormones. This increase in turn stimulates the parasympathetic centers in the interbrain. These parasympathetic centers in turn powerfully stimulate the pituitary to produce melanophore-expanding hormones, probably acting on the retina pigment and, independently, stimulating the interbrain, thus closing a vicious circle.

Dr. Von Sallmann asked: (1) How many patients of the series presented by Dr. Givner showed obesity and hypogenitalism in addition to other diencephalic pituitary signs? (2) Does Dr. Givner see any similarity between retinitis pigmentosa and the destruction of the retina induced by iodate? (In Dr. Sallmann's opinion there is none—either in patients with iodide-iodate intoxication or in the experimentally produced lesion in rabbits.) (3) Does Dr. Lowenstein's theory on the mechanism in the diencephalic disturbance explain the cases of retinitis pigmentosa with intestinal spasm which are relieved by adrenalin? (4) Did the X-ray examination of the sella show an abnormality in Dr. Givner's series?

Dr. Givner said that Dr. Bruger's and his findings are not in disagreement with

Dr. Lowenstein's theory of the pathogenesis of retinitis pigmentosa. Tendencies toward the lower limits in the basal-metabolism rate and toward low vitamin-C content are commonly found in vagotonia.

In answer to Dr. Von Sallmann, only their first case showed obesity and other clinical evidences of pituitary dysfunction. In regard to Kalt's experiment of injecting sodium iodate, they do not believe retinitis pigmentosa was produced, but a pigmentary disturbance of the retina was. Because Kalt felt that liver disturbance may be present in retinitis pigmentosa, they did the sensitive cephalin flocculation tests and found them negative.

In answer to the question regarding relief of intestinal spasm by adrenalin in cases of retinitis pigmentosa, the stimulation of the sympathetic might well counterbalance the vagotonia suggested by Dr. Lowenstein's theory. Finally, X-ray examination of the sella was not done routinely, but in those cases where it was, normal findings were encountered.

OCULAR CHANGES IN RATS, ON AMINO-ACID (VALINE) DEFICIENT DIET

DRS. ARMANDO FERRARO and LEON ROIZIN described experiments in which young and adult rats (Sherman's stain) of the same sex (male), age, and litter were reared on a slightly modified valine-deficient diet as described by Rose.

The duration of the experiments lasted from 2½ to 4½ months. Five or six weeks after the experiments were started, the rats on valine-deficient diet developed, in addition to general changes and structural alterations of other organs which are still objects of microscopic studies, corneal changes leading to opacities. These seemed to be the results of edema, hyperplasia, and progressive degeneration of the epithelial cells leading gradually to keratinization and disorganization, most-

ly of the superficial layers of the interpalpebral cornea. In addition, pronounced vascularization was observed. Slight changes of the lens, characterized mostly by vacuolization of the cortex, were only occasionally noticed.

These structural changes of the eye appeared to be reversible in character, if treated in time, as demonstrated by the marked improvement following the administration of the synthetic valine to the animals on valine-deficient diet. This condition is being described as "nutritional corneal dystrophy" until further investigations are completed.

Discussion. Dr. Isadore Givner said that the amino-acid requirements for man may differ both qualitatively and quantitatively from those of the rat so that direct application to man of the results of experiments on animals cannot always be made.

Since there is, as yet, no suitable and reliable laboratory method for the detection of specific amino-acid deficiency, studies such as this are of importance. Eight of the 22 amino acids found in proteins have essential specific functions, yet they cannot be synthesized by the body. Hence, specific amino-acid deficiencies may occur, and it may fall to the ophthalmologist to detect early valine deficiency.

In general, proteins are important in the osmotic relation between intracellular and extracellular fluid. Although edema is not the earliest result of protein deficiency, it is, in our present state of knowledge, about the first clinical sign of deficiency. It is not surprising that the first change observed in the cornea in valine deficiency is edema of the corneal epithelium. Interestingly enough, the edema is usually confined to the interpalpebral area. In one case, however, a bulous keratitis developed in the center of the cornea, while edema of much

less degree was found over the remainder of the cornea. Following this change as the deficiency progressed, the most superficial layer became keratinized and in one instance showed stippling after fluorescein was instilled and irrigated out. The edematous process is reversible.

The vascularization is very interesting in that it is all deep, starting as an arcade at the periphery and then becoming extended into the deep stroma. This is in marked contrast to tryptophan deficiency in which the vascularization is superficial. Under treatment, the lumen becomes reduced in width and becomes bloodless. The changes in the lens are minimal. In some of the cases studied, no opacities were found; in others, they were found only in the anterior portion of the cortex and were not sufficient to obstruct ophthalmoscopic study. The remainder of the eye was normal. This was verified on histologic study.

HYDROGEN-ION CONCENTRATION OF THE AQUEOUS

DR. LUDWIG VON SALLMANN used two glass electrodes, especially designed for measuring the pH of the intraocular fluids in vivo. For determination of the hydrogen-ion concentration in the aqueous, the electrode consisted of a micro-papillary and was armed with a fine needle which was inserted into the anterior chamber. The pH of the vitreous was determined with a membrane electrode. Great care was taken to avoid erroneous readings due to the uncontrolled escape of carbon dioxide and due to inaccuracies in temperature control. It was found that the anatomic conditions of the eye were extremely well-suited for this type of in vivo procedure. The physiologic pH of the aqueous fluid in rabbits ranged between 7.44 and 7.49 at the early phase of general anesthesia with a barbiturate. Local anesthesia and pro-

longed general anesthesia altered the pH of the aqueous inversely; that is, local anesthesia caused a shift to the alkaline side, and general to the acid side. Diets rich in alkali and the introduction of anions into the aqueous by ion transfer did not cause significant changes. A definite but moderate shift to the acid side occurred in the aqueous when the vitreous was the site of a bacterial infection. The use of the electrodes and the technique designed for the determination of the pH in vivo gave information unobtainable with other procedures on the hydrogen-ion concentration of the aqueous and vitreous in physiologic and pathologic conditions.

INFLUENCE OF SYMPATHOMIMETIC DRUGS ON THE REGENERATIVE PROCESSES OF THE OCULAR EPITHELIA

GEORGE K. SMELSER, PH.D., studied the effect of topical applications of a number of sympathomimetic drugs on mitosis in the corneal epithelium of 87 animals to determine if they were similar in their action on this process. Epinephrine, neosynephrine, ephedrine, benzedrine, and privine were used in addition to pitressin, which was included because of its action as a vasoconstrictor. Four of these compounds, applied topically to the eyes of rats at hourly intervals, caused a marked decrease in cell division in corneal epithelium. Pitressin and privine lacked this effect, although they caused a prolonged blanching of the conjunctiva.

No mitotic inhibition was noted in the conjunctival epithelium of the epinephrine-, benzedrine-, and neosynephrine-treated animals in which a marked depression of mitosis in the corneal epithelium was demonstrated. Privine and pitressin were without effect on mitosis in the conjunctiva but ephedrine (0.5 percent) inhibited cell division significantly in two thirds of the animals.

These drugs were also applied topically at two-hour intervals to standard thermal burns of the cornea in order to determine their effect on regeneration of the corneal epithelium. All of the compounds caused some delay in healing, but this was very slight in the case of epinephrine (1:2500) and pitressin. The only extreme delay in healing was caused by privine, an unfortunate paradox, in view of the entire absence of harmful effect of this drug on mitosis in the intact cornea.

Leon H. Ehrlich,
Recording Secretary.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

March 12, 1946

DR. T. S. LEATHERWOOD, *presiding*

METASTATIC ENDOPHTHALMITIS

DR. P. M. LEWIS and DR. G. M. WALLACE reported the case of M. C., a 17-months-old colored girl, who was seen on the Ophthalmological Service of the John Gaston Hospital on January 28, 1946.

The anamnesis as given by the mother was that for a week or 10 days prior to the onset of the present illness the child had been receiving injections for relief of painful joints. The nature of the medication was not learned. Forty-eight hours before admission, her left eye became red and the lids seemed to close slightly. No other pertinent information was elicited; however, the hospital records revealed that the child had a nonspecific vaginitis at the time of birth.

Examination revealed the girl to be normal except for the left eye. The lids of this eye were normal in structure but partly closed; the conjunctiva and episcleral tissues were highly and diffusely inflamed; the iris and lens could not be

identified as such; the tension was normal, as were the extraocular movements.

Treatment instituted upon admission consisted of the administration of 10,000 Ox.u. of penicillin every 3 hours; 5 gr. sodium salicylate, 4 times daily; warm boric-acid compresses for 15 minutes, 4 times daily. Atropine-sulfate ointment (1 percent) was applied once daily. In 24 hours, the condition had so changed that the periphery of the iris could be seen. At this time it was felt a metastatic endophthalmitis was present. The following laboratory tests were made, and the results revealed the urine to be normal; red blood corpuscles to be 3,780,000 per c.c.; white blood corpuscles to be 11,950 per c.c.; a blood culture to be negative on the fifth day of incubation; a smear from the vagina to have no pathogenes. X-ray studies of the chest reported a right sided broncho-pneumonia. Consultation with other departments did not reveal any obvious foci of infection.

Six or seven days after admission the hypopyon cleared entirely, and two narrow, posterior synechiae were present at the 12-o'clock position. Later these synechiae disappeared. The pupil became widely dilated, and the lens appeared to be uninvolved; however, it was then possible to see a white, dense mass filling the vitreous body immediately behind the lens. The eye lost the greater part of its angry appearance as well as some of its normal ocular tension, but it did not become exceedingly soft.

The patient did not appear to be acutely or seriously ill. Her appetite was fair. Her temperature was elevated only during the first five days of hospitalization, during which time it did not exceed 101° F. She was seen last on February 13th, three days after discharge from the hospital, at which time her condition was slowly improving. Because of the extreme youth of the patient, it was not possible

to determine the degree of vision present in the eye.

TRAUMATIC OCCLUSION OF THE CENTRAL RETINAL ARTERY

DR. P. M. LEWIS and DR. G. M. WALLACE presented the case of R. F., an 11-year-old colored boy who was seen on the Ophthalmological Service of the John Gaston Hospital on March 4, 1946.

The history revealed that 24 hours before admission to the hospital the boy had accidentally fallen upon a stick, and the force of the fall had been sustained by the left orbit and its contents. A very small quantity of blood escaped the wound; pain was severe momentarily but subsided in a short time; amaurosis developed immediately and persisted in the left eye. Other information was not pertinent to the present illness.

With the exception of the findings in the left eye and orbit, the physical examination revealed a healthy child. The anatomy and functions of the right eye were normal. The palpebra of the left eye were moderately swollen. Superficial abrasions, present at the junction of the mesial and middle thirds, were directed vertically in their greatest length. There was minimal ecchymosis of the lids. The extraocular movements were normal in all directions except temporally. Limitation in this direction was accompanied by pain. The tension of the left eye did not feel abnormal to palpation. A subconjunctival hemorrhage measuring 6 to 7 mm. in diameter was present over the area of the tendon of the lateral rectus muscle. The cornea glistened normally and did not show any abnormalities. The anterior chamber and aqueous were also found to be normal. The pupil was moderately dilated. It did not respond to light and dilated widely when 4-percent cocaine and 1:1000 adrenalin-chloride solutions were instilled. The pupillary response was

not determined with the use of miotics. No structural abnormalities of the iris could be detected; however, the patient was not subjected to slitlamp examination. Although the vitreous and retina contained numerous dense hemorrhages, there was nothing unusual about the lens. The hemorrhages in the vitreous were quite dense and well-defined, and they appeared to be limited by some organic structure or membrane which prevented their diffusion throughout the entire vitreous body. The masses of blood could be seen to be slowly gravitating in mass toward the dependent positions after agitation; one large, dense mass was localized immediately anterior to the papilla and precluded visualization of that structure. The retinal hemorrhages were irregular in size, shape, density, and location. The retina throughout most of its extent was quite white and edematous; however, the inferior nasal quadrant in the area of the equator of the globe had an almost normal coloration. Immediately adjacent and inferiorly to this there was evidence of a retinal separation. Observation at first showed the veins to be full and the arterioles absent of blood except in a few sites where the "cattle-truck" effect was present. Forty-eight hours later fundal examination revealed the veins in certain areas to be entirely absent of blood, the "cattle-truck" effect also present in the veins, and the arterioles unchanged in appearance. The expected macular abnormality was present.

Routine-laboratory urine and blood findings were normal; light perception remained absent; the intraocular pressure variation was not pathologic; and the patient was discharged without treatment from the hospital on March 7, 1946, and sent to the out-patient ophthalmological service to be followed for further observation.

CYST OF THE IRIS

DR. PHILIP MERIWETHER LEWIS presented a patient on whom he had recently operated for a large iris cyst. The patient, a white man aged 26 years, had had his left eye injured, in 1938, by a piece of steel which was removed by operation. The vision was almost entirely lost by this accident. The patient was first seen at the Eye Clinic of the University of Tennessee in January, 1945. He was having severe pain in the left eye which was highly inflamed, with a steamy cornea and tension of 50 mm. Hg (Schiotz). A grayish mass filled a large portion of the anterior chamber. Vision was perception of light only. The patient was admitted to the John Gaston Hospital for treatment and probable enucleation. When the cornea cleared slightly, it could be seen that the gray mass was a large cyst of the iris and that the lens was completely opaque.

Removal of the cyst was attempted, but was only partly successful. The cataract was removed in its capsule. Following this the eye did well for several weeks, but the cyst reformed and grew rapidly, extending from the 4- to the 6-o'clock positions and upwards above the center of the cornea. On March 9, 1945, a keratome incision was made just above the temporal border of the cyst. The incision was enlarged with scissors downwards to the 7-o'clock position. The cyst was removed with forceps and scissors. The eye has been comfortable since operation. Uncorrected vision was the counting of fingers at about three feet.

DIATHERMY TREATMENT IN RETINAL ANGIOMATOSIS

DR. PHILIP MERIWETHER LEWIS presented Mrs. M. P., aged 34 years, a white woman, upon whom he had operated for angioma of the retina.

The patient was first seen in July, 1944, while she was confined to the John Gaston Hospital for general medical studies to find the cause of severe headaches. The angioma was found when the fundi were examined for possible papilledema. Complete general physical and laboratory examinations were negative and the consulting neurosurgeon felt that there was no evidence of cerebellar involvement. The right eye was normal. The disc of the left eye was slightly blurry. Below the disc, two very large blood vessels coursed tortuously downward and forward to a tumor mass in the 6-o'clock median, between the equator and the ora serrata. The tumor mass was about $1\frac{1}{2}$ times the size of the optic disc and of a light, reddish-brown color. The retina surrounding the tumor mass was not detached. Vision was: O.D., 20/20; O.S., 20/100. There was a large contraction in the superior visual field corresponding to the angioma.

Destruction of the angioma with diathermy, using the Walker pins, was done on September 6, 1944, at the Memphis Eye and Ear Hospital. Essentially the same technique as that described in a previous case report* was used. A large retinal detachment developed, probably due to holes made in the retina with the pins. The detachment gradually became worse; so on September 26, 1944, an operation was performed with the hope of reattaching the separated retina. Following this, the vitreous was hazy for a long time which prevented a clear view of the fundus.

The patient was sent home about four weeks later with pin-hole spectacles. Iodides, internally, and the passage of time gradually cleared the vitreous so that the fundus could be clearly seen. When last

examined, February 18, 1946, her vision was 20/30 and J2. Extensive scarring and pigmentation covered both the site of the angioma and a considerable area. The retina was completely reattached. Except for a very small central canal containing blood, the large artery was converted into fibrous tissue. The vein was much reduced in size but was still considerably larger than normal. There was no evidence of a recurrence of the angioma.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

March 21, 1946

DR. BURTON CHANCE, *chairman*

VASCULAR DISEASE ASSOCIATED WITH ANGIOID STREAKS OF THE RETINA AND PSEUDOXANTHOMA ELASTICUM

DR. HAROLD SCHEIE and DR. NORMAN E. FREEMAN presented three patients having angioid streaks of the retina, two of whom showed marked disturbances of peripheral circulation. These two patients also had skin changes of pseudoxanthoma elasticum. The third patient had no skin changes, but did have essential hypertension. In view of the vascular changes in the other two patients, it was thought that the hypertension showed by the third patient could have been due to similar changes in his renal arteries.

The other two patients showed diminution or absence of peripheral pulses determined by oscillometer readings. Occlusion of one or more peripheral arteries was seen in both patients. The femoral arteries of both patients were calcified and could be visualized by X-ray. Biopsy of the skin and ulnar artery of one patient revealed the classical changes of pseudo-

* Published in the *Archives of Ophthalmology*, 1943, volume 30, August, page 250.

xanthoma elasticum in the skin and unusual changes in the arteries. The elastic tissue within the arterial wall was fragmented and broken up. The lumen was occluded or nearly occluded by marked hyperplasia of the muscularis, possibly as a result of loss of elastic tissue support.

Suggestion was made that physicians having patients with the angioid streaks of the retina of pseudoxanthoma elasticum should review them from the point of view of vascular disease. Since either of these two conditions can occur as the predominant feature of this generalized elastic-tissue disease, the disturbance in the blood vessels might, in some cases, be the only or most marked manifestation. This should be kept in mind, and ophthalmoscopic examinations should be carried out in all obscure disturbances of peripheral circulation, for the condition greatly resembles Buerger's disease.

Discussion. Dr. Francis Heed Adler said that the thesis of this communication was well-founded; that is, that angioid streaks of the retina, Paget's disease, pseudoxanthoma elasticum, and some forms of peripheral vascular disease are parts of the same clinical entity, which is not as yet completely elucidated.

The pathology of the arteries is not entirely clear, as was evidenced by the fact that a number of pathologists to whom these sections were shown were somewhat puzzled by them. However, the general consensus of opinion seemed to be that they were dealing with a disease process confined to the elastic tissue of the arteries. Although it has been mentioned in the literature that such changes might be present, it seems strange that no one, until now, has made a study of the elastic-tissue changes in the arteries in these cases.

These findings tend to confirm the opinion that the pathologic condition underlying angioid streaks in the retina is

a degeneration of the elastic tissue of Bruch's membrane.

Dr. Adler concluded by saying that he was grateful for the opportunity to hear this interesting and beautifully presented work.

Dr. George F. J. Kelly asked Dr. Scheie whether he had had much to do with getting this section of artery. After all, this artery was a little patulous. When this piece was removed, was the collateral circulation sufficient to carry on? One can obtain sections of skin and of similar tissues, but obtaining a section of an artery is a bit unusual.

Dr. Frank B. Walsh said that it was interesting that pseudoxanthoma elasticum was associated with angioid streaks in all the cases described. How frequently had the essayist seen angioid streaks in the absence of changes in the skin?

Dr. Harold Schie (closing) in reply to Dr. Kelly, said that the biopsy was taken with very little hesitation because the ulnar artery was completely occluded. Microscopic evidence further justified taking the biopsy by verifying the occlusion. The wall of the artery and the tissues surrounding the artery showed newly formed and anastomotic vessels as large as the very minute residual lumen of the ulnar artery. The presence of a residual lumen was even debatable. If the artery was examined several sections higher, what seemed to be residual lumen at the lower level had shifted to one side and looked like any of the anastomotic vessels. The patient was an intelligent soldier who understood the situation when it was explained to him. He was told that he would derive no benefit from the procedure, but that, if further information could be obtained, it might possibly aid others in the future.

In answer to Dr. Adler's question: Clinical disease of the peripheral vessels has not been mentioned in the literature.

Sholz did mention absence of peripheral pulses in one patient, but apparently he considered it no further. Several references to histologic elastic-tissue degeneration in vessel walls were found as part of routine microscopic studies.

A COMPARISON OF THE OCULAR SIGNS IN CHILDREN AND ADULTS SUFFERING FROM SUBDURAL HEMATOMA

DR. FRANK B. WALSH, Baltimore (by invitation), spoke on this subject. His study was based on case records of 36 infants and 54 adults. He said that the condition occurs almost exclusively in infants or children less than two years of age and in adults over 20 years of age. Trauma is unquestionably the etiologic factor in adults. There is bulging of the fontanel in a majority of infants. Both in infants and in adults there may be absence of neurologic signs but irritability and drowsiness are commonly present. The hematoma is usually unilateral in adults and bilateral in children. The spinal fluid in infants usually contains blood or is xanthochromic; whereas, in adults it almost invariably is normal.

The ocular signs. In adult patients we have not found the incidence of papilledema as high as other observers (Dandy, King, Furlow). Retinal hemorrhage was frequently present in infants, but not in adults. Both in infants and in adults dilatation of the pupil may occur. In adults such dilatation usually is on the side of the hematoma. The sign is not as important in infants, because usually in them the lesion is bilateral. Ptosis was observed contralateral to the lesion in six of our cases. Such ptosis may be supranuclear in origin, but it may be evidence that there are multiple lesions. Conjugate deviation of the eyes away from the side of the hematoma probably is due to a lesion in the hemisphere opposite the hematoma.

Pathogenesis. A point of difference between the infant and adult brain may be important as regards differences in symptomatology in these two groups. In the infant unsupported veins enter the superior longitudinal sinus. In the adult pachionian granulations serve to bind together the dura, arachnoid, and longitudinal sinus.

Discussion. Dr. J. Parsons Schaeffer said that he would like to know how many of the subdural hematomas in the earlier ages were the result of birth injuries. He also asked a question about the variation in the size of the optic foramen through which the optic nerve passes into the orbit. When the size is roomy, it might be inferred that the subdural hemorrhage would readily pass into the dural-arachnoid interspace; when blood does not so pass, it might be considered as due to the bony encroachment on the optic nerve and its sheaths and interspaces.

Dr. Francis Heed Adler said that the high incidence of subdural hematomas in infants could be logically explained by the prevalence of birth injuries. Every normal birth exposes the child to cranial compression. When one considers that the fontanels are open at birth and for some time after birth, it is no wonder that there should be a high incidence of intracranial trauma. From the time the fontanels close, the child is not often exposed to any serious intracranial damage until he reaches the age at which serious accidents are apt to occur. In other words, the falls and bumps of the nursery do not produce intracranial pathologic conditions, but industrial accidents often do. It would seem to be much more logical to assume that this was the explanation of the distribution of subdural hematomas according to age, rather than to base an explanation on an anatomical difference between the cranial contents of the infant and the adult.

Dr. Adler said that Dr. Walsh had asked him to comment on ptosis as a sign of supranuclear paralysis. Since the lid muscles have a separate representation in the frontal cortex, it is possible to have a supranuclear paralysis by a lesion situated anywhere from the cortex on down to the nucleus. This, of course, is not true of the individual muscles controlling the movements of the eyeball. Further than this, the fiber tracts for the levator and orbicularis (this latter is questionable) run together with the fiber tracts for upward and downward movements of the eyeballs in the region of the corpora quadrigemina. Accordingly, lesions in this neighborhood cause disturbances of upward and downward movements of the eyes, together with ptosis and tucked lids. A few years ago, Collier called attention to ptosis and lid retraction as signs of supranuclear paralysis of the third nerve; thereby differentiating these lesions from those affecting the third nerve, itself, or the nucleus. If the lesion be anterior, lid retraction is apt to be present; whereas, if the lesion be posterior, ptosis occurs.

Dr. Walter I. Lillie said that Dr. Walsh was to be congratulated on his presentation of a very difficult subject, since the classification of traumatic cerebral changes is not always too well-differentiated. Clinically, it is often difficult to correlate the multiple bizarre changes with a single lesion. Although a single large lesion is present, associated small multiple lesions help to explain the syndrome. Dr. Lillie said that Dr. Walsh had not specifically explained why a subhyaloid hemorrhage occurs in infants and not in adults. The occurrence of subhyaloid hemorrhages in adults is usually associated with a compression injury to the chest or the neck, but it is possible that it may occur from intracranial venous compression.

The diagnosis of subdural hematoma is

usually supported by an encephalogram, as the variations in the fluid channels reveal the space-taking lesion.

The occurrence of general convulsions in adults should suggest a frontal, temporal, or occipital-lobe lesion. In such cases, a routine perimetric-field examination should be instituted. Many times a quadrantal homonymous hemianopsia has been found a year or two in advance of other definite signs of a space-taking lesion.

Dr. Henry A. Shenkin said that he would like to add a few remarks from the neurosurgeon's point of view. Dr. Walsh made an effort to distinguish between subdural hematoma in the child and in the adult, and it is true they are quite different. The fact that there are open fontanels in the infant would well account for the difference in symptomatology.

Papilledema does occur in adults but it has been Dr. Shenkin's experience that it rarely is seen in infants. The fact that the fontanels are open could permit sufficient expansion of the calvarium to absorb the pressure. The presence of convulsions in childhood may well be due to a lowered convulsive threshold, said to be characteristic of infancy. However, the length of time to which the cortex is subjected to irritation may be the convulsive factor. It is known that brain tumors of slow growth are the ones most frequently associated with seizures; subdural hematoma of long duration may be more frequently associated with seizures. The open fontanels, compensating for the increased mass of the hematoma, permit the child to survive for periods far in excess of the usual time in which the life of an adult would be threatened by a chronic subdural hematoma. It is likely that the subdural hematoma of infancy is caused by birth trauma. The appearance of the lesion, and the history of the child's development substantiate this. Physicians are

usually consulted when the child is 6 to 12 months of age. In the case of adults life-threatening symptoms from chronic subdural hematoma usually develop in 6 to 12 weeks after their injury.

Unilateral dilatation of the pupil is more characteristic of acute subdural hematoma than of the chronic form. Dr. Shenkin said that he believed subdural hematoma of infancy to be more analogous to the latter entity than to the former. Indeed, ipsilateral dilatation of the pupil is far more characteristic of the fulminating syndrome of acute epidural hemorrhage than of the more slowly developing acute subdural hemorrhage.

He agreed that the results of treatment of subdural hematoma of infancy are poor. This could be explained by the delay in making a proper diagnosis. The growing brain is compressed for undue periods of time, and often it never recovers sufficiently to develop to its full capacity.

Dr. J. Parsons Schaeffer said that he would like to bring out these two points. First, there is some thought that the facial nerve may, in some manner, cause the peculiar behavior of the upper eyelid in certain cases. Some of the fibers that arise from the nucleus of the oculomotor nerve descend in the medial longitudinal fasciculus and either terminate about the cells of the nucleus of the facial nerve or join the facial nerve as such, passing in the facial nerve to the upper part of the orbicularis oculi muscle; thus, associating the innervation of the levator palpebrae with that of the orbicularis oculi. Although it is generally accepted that the oculomotor supplies the levator palpebrae and the orbicularis oculi is supplied by the facial, this intermingling of the fibers of the two nerves may well be variable enough to account for such peculiar manifestations with reference to the action of the upper eyelid. Much more study needs to be done.

The second point concerns the new-born

infant to which the speaker referred. There is no doubt that the veins, as they course to enter the superior-sagittal sinus, are fairly free. It is, however, equally true that the mesothelium covering them does not add much protection. Later, in the adult, as the brain membranes become more pronounced and the interspaces are developed, the parts become matted together near the superior-sagittal sinus. Also, the arachnoid and the subarachnoid spaces in the form of arachnoidal granulations are protruded into the superior-sagittal venous sinus; the endothelium, of course, is crowded ahead. This adds further to the crowding near the venous sinus and to the encroachment upon the cerebral veins as they enter the dural sinus.

Dr. Frank B. Walsh (closing) replied to Dr. Schaeffer by saying that, in some infants, birth injury was a possible explanation for subdural hematoma but that it was extremely doubtful if this was so in a majority of infantile cases presented. They have not made studies on the optic foramina.

Dr. Adler's explanation of supranuclear ptosis involving the lid opposite the hematoma is interesting. However, there is no characteristic feature in such a ptosis that would eliminate the possibility of it having been produced by a homolateral, uncompleted, third-nerve palsy. It is well that attention was drawn to Collier's paper, which is excellent.

Dr. Walsh agreed with Dr. Lillie that there may be multiple lesions in these cases. He was unable to explain the pre-retinal hemorrhages seen in cases of subarachnoid hemorrhage. It is thought such retinal hemorrhages are venous in origin. One would think they might be associated with sudden increase in intracranial pressure. However, Gardner has shown that the intracranial pressure in many cases is not increased.

George F. J. Kelly,
Clerk.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

January 15, 1946

DR. THEODORE L. TERRY, *presiding*

A METHOD OF ENTOPTIC SCOTOMETRY

DR. JOSEPH L. LO-PRESTI read an interesting paper on the above subject. Dr. Lo-Presti said that the minute, constantly moving entoptic particles best seen through blue or red-blue filters may be used as test objects in central scotometry. These have been called red or white blood corpuscles but the more noncommittal term "motes" is proposed because of their small size and motion. These two features, together with their presence throughout the entire field all at the same time, make them ideal test objects. An apparatus was devised to measure and record those areas where they are absent, scotomas. This consists of a brilliant source of illumination; a 10 diopter, wide lens to achieve Maxwellian illumination in the eye; an iris diaphragm with cross hairs; a well to hold, at a distance of 190 mm. from the eye, cleared X-ray film on which scotomas are outlined by means of a soft crayon; a water cell containing a solution of saturated copper sulfate and basic fuchsin transmitting wave lengths of 350 to 470 and 550 to 620 μ ; and a chin rest.

A small, central area free of motes, the blood-free area of the fovea, is present in all normal fields. In 10 normal subjects this was found to measure from 1.2 to 2.4 mm. and was identical for both eyes. These figures agree with the average reported by Sperling, Miller, and Adler in 78 normal eyes, 1.5 mm.

To rule out extraocular factors, 10 cardinals, 3 anemics, and 2 leukemics were studied and found to have normal-size, mote-free areas. If increasing pressure is brought to bear on the eye examined, the

motes first slow down and finally stop. Using a Baillart ophthalmodynamometer, pressure readings of 80 to 120 gm. had to be exerted before the motes stopped moving in 25 normal subjects. For the 15 subjects with cardiovascular disease and blood dyscrasias, pressure readings were found within this range.

A total of 65 cases, divided into three groups, was reported: (1) those showing close correspondence with results employing the Evans method of campimetry (30 percent); (2) those showing fair correspondence (50 percent); (3) those showing poor to no correspondence (20 percent). These groups included cases of old chorioretinitis, retinitis pigmentosa, occlusion of branch of retinal artery, traumatic hole of macula, multiple sclerosis, tobacco amblyopia, juvenile and senile macular degeneration, diabetic chorioretinopathy, retinal separation, and quinine amblyopia.

Dr. Lo-Presti stated that in all cases of active disease of the posterior segment of the chorioretina a markedly reduced pressure reading was shown to obliterate motion of the motes.

EFFICIENCY OF CYCLOPLEGICS

DR. S. JUDD BEACH made some remarks regarding the efficiency of cycloplegics, in the absence of Dr. Alexander E. MacDonald who was to have been guest speaker of the evening and who was to have read a paper on "War-time Research in Ophthalmology." Dr. Beach said one factor in the contradictory pronouncements regarding the efficiency of cycloplegics is the variation in the response of different individuals rather than the different types of drugs used. Another is the unreliability of the tests for depth of cycloplegia. Three common tests are:

1. Nearpoint test, made by placing usually a +3.00D. sph. before the eye

corrected for distance. Type should then focus at 13 inches. The advantage of this method is that residual accommodation is stimulated by approaching type to eye but measurements are increasingly subject to error the nearer the type approaches the eye, and vary with the personal equation.

2. Placing test type at focal point of convex lens. Then estimate residual accommodation by noting the highest concave lens which can be overcome.

3. By retinoscopy.

Dr. Beach said further that there seemed to be no sound reason for the popular method of cycloplegia which employs atropine three times a day for three days in children; homatropine five times in an hour for young adults or scopolamine twice in an hour at any age. In general, this method does not increase the depth of cycloplegia beyond that resulting from single instillations of the same drug. Resistance to the drugs varies with individual idiosyncrasy rather than method of administration. It may even differ in the two eyes of the same person.

According to Dr. Beach, three sorts of response can be identified:

1. Complete relaxation both for near and distant vision.

2. Complete relaxation for distant vision with residual accommodation active at near.

3. Accommodation in evidence both for near and distant vision. This occurs in about 10 percent of all cases. Contrary to common belief, resistance to cycloplegia is not a property of younger ages, nor of higher astigmatic errors.

In closing, Dr. Beach said that dibotulin, a nonmydriatic cycloplegic, seems about as effective for distant vision as homatropine. Cycloplegia gives valuable information but is not as reliable as is generally believed. Mahlon T. Easton,

Recorder.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

February 19, 1946

DR. HOWARD F. HILL, *presiding*

EXPERIENCE IN OPERATIONS ON THE SUPERIOR AND INFERIOR OBLIQUE

DR. CONRAD BERENS read an interesting paper on the above subject. Dr. Berens observed that during the past 20 years he has performed an increasing number of operations on the vertical acting muscles, especially on the inferior obliques. In his study of results following surgery, it became apparent to him that failure to obtain good binocular vision or functional results was caused most commonly by hyperphoria or hypertropia. He pointed out the importance of carefully observing the anatomic relationship of the attachment of the inferior oblique to the globe. In freeing the muscle from its attachment, one must be careful not to injure the optic nerve; and when re-attaching the inferior oblique, care must be taken not to puncture the inferior vortex vein. He also stressed the importance of the suspensory ligament of Lockwood and the condensation of Tenon's capsule forming the ligament between the inferior oblique and the inferior rectus muscle.

The following indications for retroplacement of the inferior oblique were outlined:

1. Moderate degree of monolateral or bilateral hypermetropia or hyperphoria caused by a paresis or paralysis of the contralateral superior rectus, with or without marked spasm of the inferior oblique.

2. Esotropia complicated by spasm of the inferior oblique, causing an upshoot of the eye as it is adducted.

3. Paresis of the superior oblique and secondary spasm of the inferior oblique of the same eye.

4. Fibrosis of the lateral rectus muscle with secondary spasm of the inferior oblique of the same eye. The average effect on 97 patients for a 1 mm. retroplacement of the inferior oblique was at 6 m., 0.9^{Δ} ; at 25 cm., 0.9^{Δ} in the primary position. In the field of action of the inferior oblique at 25 cm., the effect was 2^{Δ} . The average effect obtained by myotomy of the inferior oblique at the orbital margin was in the primary position at 6 m., 5.3^{Δ} ; at 25 cm., 7.7^{Δ} ; and in the field of action of the inferior oblique at 25 cm., 11^{Δ} .

The indications for advancement of the inferior oblique at the orbital attachment were suggested as: (1) Hypertropia associated with homolateral pseudoptosis, the result of the depressed position of the eyeball when caused by paresis of the inferior oblique. (2) Postoperative paresis of the inferior oblique, especially when cyclotropia prevents fusion. (3) Paresis of the inferior oblique associated with lateral deviations. (4) May be combined with an advancement of the superior rectus.

Dr. Berens also suggested transplantation of the superior oblique for complete third-nerve paralysis. He first corrected the heterotropia and then, if binocular function was adequate or diplopia could be disregarded, he corrected the ptosis.

In conclusion, Dr. Berens again emphasized that he had found a careful study of the oblique muscles and correction of their anomalies by surgical intervention to be one of the most important factors in obtaining good functional results in the surgery of the ocular muscles. Because the importance of the obliques has become increasingly apparent in the department of motor anomalies of the New York Eye and Ear Infirmary, he now has records of more than 700 operations which have

been performed on the inferior obliques.

SOME EXPERIMENTAL AND CLINICAL OBSERVATIONS CONCERNING STEREOPSIS

DR. HERMAN M. BURIAN read an interesting paper on the above subject. Dr. Burian said that stereopsis is a perception sui generis. It is not simply one aspect of even the highest refinement of single binocular vision. It is to some extent independent of single binocular vision, since it can be shown to exist in diplopia, where there is simultaneous binocular perception but not single binocular vision. On the other hand, stereoscopic perception may be electively suppressed. This means that single binocular vision exists only for identical images, while the disparate elements of stereoscopic pictures are suppressed. This elective suppression may be regional and limited to the central retinal area. Although stereoscopic sensitivity in normal individuals is, to some extent, a function of visual acuity in that it decreases from the center to the periphery of the retina in the same ratio as does the visual acuity, a certain independence is again shown by the function of stereopsis. Patients who suppress centrally the stereoscopic elements may have perfectly normal visual acuity; while others who have an amblyopic eye may show a surprisingly high degree of stereoscopic sensitivity.

Dr. Burian concluded by saying that this was not the time to go into the theoretical implications of the facts he had mentioned but that he believed it safe to say that stereopsis is a physiologic process; that is, stereopsis is the result of stimulation of specific central nervous arrangements by specific stimulus patterns. It is not a psychologic process, as is the fashionable belief in some circles.

Mahlon T. Easton,
Reporter.

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ADVANCES IN THE CARE OF MUSCLE ANOMALIES

On a recent trip to the Middle West, discussion with a colleague brought out the comment that there was still much to be desired in the results obtained from muscle surgery. It must be admitted that at times our results are very disappointing even after detailed preoperative study.

However, a review of the change that has taken place in the care of muscle anomalies during the last 25 years shows

that, while there is still much to be learned, great advance has been made during that time.

I have recently had the occasion to go over some records of squints operated upon by my late chief 30 to 35 years ago. The "muscle workup," as measured by our present standards, was very incomplete. The child was refracted to determine the amount of the refractive error and its possible relation to the squint. The amount of squint was measured on the perimeter

and gross tests were made for the presence of ocular palsies. No prism measurements were made and very little attention was given to the difference in prism diopters, between the degree of squint for distance and near. The obliques were "holy ground" and received very little attention, the edict being that they should be left alone.

The surgery consisted of an advancement or resection of one muscle and a complete tenotomy of the opponent. The operator took pride in being able to correct the squint in one operation, irrespective of the amount, and looked upon the surgery as a failure if this was not accomplished. The effort was to obtain an immediate "cosmetically good" result. The fact that convergence might be absent or that there might be limitation of the tenotomized muscle was no deterrent. No attempt was made to give the child preoperative training in the hopes of preparing the ground for the establishment of binocular vision. Postoperatively, attempts were made to establish some form of fusion by the use of the stereoscope. Very little effort was made to improve the vision of the amblyopic squinting eye. As late as 1928, Ernst Fuchs* in discussing the amblyopic squinting eye states: "The most important argument has been over the improvement of the vision of the amblyopic eye by its use. Attempts have been made to do this by prolonged occlusion of the nonsquinting eye. The prolonged occlusion of the well eye is not practical, and the daily occlusion of the eye for an hour is useless. For this reason I long ago discarded this procedure which is still used rather extensively."

This, then, was the attitude of the average well-trained ophthalmologist of

the last generation, particularly the European-trained man.

However, in that same generation such men as Duane, Jackson, Worth, and others were doing original work on extraocular muscles which was to lay the foundation for our more modern conception. More recently this was advanced by the work of Peter, Bielschowsky, and White. A comparison of the muscle training available to our residents and that obtainable 25 to 30 years ago brings out in a rather startling manner the advances made in the interim.

Today the final goal is the establishment of third-degree fusion in every case of squint, and while this is not possible in every instance, the percentage of successful cases is much higher than that obtained by the older methods. The proper preoperative use of occlusion of the non-squinting eye, with improvement of vision in the amblyopic eye in a large percentage of the cases; the careful measurement in prism diopters of the amount of deviation in the six cardinal directions of the gaze; the preoperative use of orthoptics: all these aid in the determination of the surgical procedure indicated.

This information also makes it possible to determine in most instances whether or not fusion will be possible. Orthoptics, intelligently used, will at times indicate that it is best not to use orthoptics and occlusion, since the result would be a troublesome diplopia.

A rather significant indication of the advancement made in the care of muscle anomalies in recent years is the new attitude toward the oblique muscles. Much has been done to improve our knowledge of the action and physiology of these muscles. The methods of diagnosis of the anomalies of the obliques have also been improved. While there is at times still a good deal of debate as to whether or not the overaction of a given oblique muscle

* Fuchs, Ernst. Aus *Meiner Augenärztlichen Praxis*; Festschrift der Königl. Universitäts-Augenklinik In Zagreb, Jugoslawien, Zagreb, 1928.

is primary or secondary, the fact remains that these muscles are better understood than they were 25 years ago.

The operative procedures used in the correction of squint, in recent years, have been designed to correct the deviation safely, and to make possible the normal physiologic action of the muscles. This is borne out by the newer procedures that have been presented for the correction of anomalies of the obliques. The detailed postoperative care received by these cases is also instrumental in evaluating the newer procedures. Thus, for example, evidence is beginning to accumulate which would indicate that recession of the inferior oblique at its insertion may be a better procedure than the tenotomy of the inferior oblique which has been used. The new operations that have been presented in the last few years for anomalies involving the superior oblique further show the advancement that is being made.

It is true that there are still many debatable points regarding squint surgery, but the amount of work that is being done in this field is constantly changing our conceptions of muscle anomalies and will continue to enhance our knowledge of the diagnosis and care of this condition.

Yes, we have come a long way in the last 25 years in the care of squint cases, and the future of this field of ophthalmology looks bright.

Frederick C. Cordes

VINTAGE OPHTHALMOLOGY: NOT A FABLE

Once or oftener upon a Time, a Physician who received his M.D. in 1919 found that he possessed many of the Attributes for specializing. Being Smart he had gone through Medical School without squandering his Gray Matter on the curriculum. He married Miss Mud City of 1920, whose Father had lost no money

as Postmaster, Sheriff, Insurance Agent, and Dog Catcher. Having thus obtained What It Takes, the Doctor went away to the Polyclinic and soon learned to speak Ophthalmology (Vintage 1921) almost like a Native. In a few weeks he returned able to perform a creditable Extracapsular Lens Extraction and with a Mydriatic could fit Glasses which seldom Bounced Back. He was absent from Class the Day they studied Perimetry, but bought the first Refractoscope in the State with red and green Traffic Lights and by 1935 owned a Slit Lamp Corneal Microscope. This he exhibited at the County Medical Meeting but was heard to say privately that for most cases he could do as well with a Loupe and Oblique Illumination. This was probably Understatement, as he was found at the Board Examination with his Face in the Chin Rest, and the Patient at the Eyepiece.

He was strong for Civic Betterment and Death on the Charlatans who foist Bogus Eyeglasses on the unsuspecting Public, and did Right by those referring him Cataract Patients. He did not own a Tonometer, finding his own experienced Touch more Remunerative. Monocular Loss of Vision which did not yield to Violet Light administered over Months from a small Cyclotron to eliminate the Toxin, he found went on to Complete Blindness. Competitors, Consulted years later, often called these cases Absolute Glaucoma or Detachment of the Retina, but they, at that Stage, could do no more for them than he could. So it soon became widely said, as he was the First to Admit, that if he could not cure you No one could.

He said his most grateful Patients were those from whom he had removed an Eye, and charged them accordingly. He kept a Stud of Cadillacs, and was Director of the Mud City Institution for Savings. By the time his Income Tax had exceeded his

net Take, and his Kick-Back from the Purveyors of Glasses was in 5 Figures, he felt that the Eye Board ought to present him with a Certificate on Record, and on the possession of Diploma from Augenkliniks in Languages that he could read no better than he could understand when in Europe. He failed to see why at the Examination, Questions should be asked in the Basic Subjects. In Optics he had practised extensively for Twenty Years without knowing which Way and how much a Prism displaced an Object; in Pathology, he pointed out the Futility of wasting Time on Glaucoma, so long as the Production of the Aqueous is in Dispute; and why learn about the Relation of the Eye to General Diseases when the Patient is to be referred to an Internist anyway? If the Examiners did not know the Answers, why ask him? They could look them up just as easily as he could.

When advised to take Post Graduate Courses in certain Clinical Subjects, he replied that he was then devoting his Time to Teaching them to his Interns. Which could throw considerable Light upon a Number of Casualties which they encountered later. So when the Board explained patiently that repeating the same Mistake for Twenty Years does not qualify an Ophthalmologist for Certification, he persuaded a Delegate to the Annual Meeting to present a Resolution that the Boards should award Certificates to Ophthalmologists who had sacrificed fifteen to Twenty-five of their Best Years to the Practise of their Profession, without demanding too much detailed Knowledge of the Subjects which they had not studied during those Years. This Wording succeeded in deceiving the Gullible into the Belief that these Subjects had been Pursued during some unspecified Period with Painful and Exhaustive Diligence. His Chairman's address at the Eye and Ear Section Meeting of the

State Medical Society concerned "Use of Penicillin in Ophthalmology and Otolaryngology." It did not differ materially in Wording from Fundamental Concepts presented in the Monographs distributed gratis by the Manufacturers of Fine Pharmaceuticals, and in Fact repeated the Misprints made in their Bibliographies and References. The Resolution failed of Passage and he now maintains that it is easy to become a Household Word and put 'em through the Wringer like a Plumber without learning the Drivel required by the Boards.

MORAL: HAVE YOU TRIED 10-PERCENT D.D.T.?

S. Judd Beach.

BOOK REVIEWS

EYE MANIFESTATIONS OF INTERNAL DISEASES. By I. S. Tassman, M.D. St. Louis, C. V. Mosby Company, 1946. Second edition. Cloth-bound, 614 pages, 243 illustrations including 24 in color. Price, \$10.00.

The second edition of this book is similar in most respects to the first. For the benefit of those who did not have access to the first volume a short review of its contents may be of interest.

The first third is for the most part confined to general textbook considerations, such as the study of the anatomy, abnormalities and manifestations, and methods of examining the patient. There seems no particular reason for including these in a book with the title such as this since they are duplicated in all complete textbooks.

Beginning with page 269, the material from then on is exactly what the title implies. The method used is the presentation of a brief description of the disease to be considered, followed with the detailed account of the ophthalmic findings. These

conditions are clearly, concretely, and interestingly given.

The illustrations are satisfactory. This second edition coming so soon after the first indicates the good reception of edition one. There are 13-percent more pages in the second than in the first edition, as well as 40 new illustrations. About eight subjects not included in the first edition are now added.

It is always important to have a book of ready reference to the eye findings in general disease and this one is well-worth owning because it serves the purpose of including so much in one volume.

Lawrence T. Post.

LES ASPECT NORMAUX ET LES ANOMALIES CONGÉNITALES DU FOND DE L' OEIL. By Danis Marcelle. Report presented to the Société Française d'Ophthalmologie, August 25, 1940.

LES ASPECT PATHOLOGIQUES DU FOND DE L' OEIL DANS LES AFFECTION DE LA RÉTINE. By Gabriel Renard. Report presented at the March 25, 1946, meeting. Price, 1,000 francs.

Although these two contributions are units of a periodical which is published irregularly, it is fitting that they be given the dignity of a book review rather than be noted in the Abstract Department, for an abstract would insufficiently emphasize the scope of this undertaking. Each volume is in reality an atlas of ophthalmoscopy that covers a limited portion of the subject. Intrinsically, each is a book, and a very fine one, illustrated with beau-

tifully reproduced colored drawings of the fundus. Together they have more than 150 pages of text.

The text of the earlier volume consists of a historical introduction and a brief description of the instruments and methods of ophthalmoscopy, including the use of filters and polarized light. A review of the anatomy of the structures accessible to ophthalmoscopic inspection forms the basis for interpretation of fundus manifestations. This material with its bibliography covers 98 pages. All fundamental facts are dealt with adequately yet without the padding that so many authors dare not leave out lest they be thought unknowing. In the remaining 101 pages of the earlier volume, congenital anomalies and variations of the fundus are described systematically. Each section has numerous black and white illustrations and an extensive bibliography. The 35 colored plates are constantly referred to for illustration of the text. Each colored plate also receives a brief comment on the facing page.

The second volume, that by Renard, is an atlas of 32 excellently printed colored drawings of the fundus in a variety of pathologic states. Degenerative lesions receive most of the discussion, and pictures exhibit many entities of diverse phases. This volume covers only a small part of fundus pathology, but, since it is numbered "one," it may be presumed that the plan is to cover other lesions in future volumes. The text consists entirely of thorough descriptions and discussions of each figure with excerpts from the clinical record of the patient whose fundus was studied.

F. H. Haessler.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
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| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

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CRYSTALLINE LENS

Barraquer Moner, J. I. Intraocular air injection in cataract extraction. Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, April, pp. 339-343.

Barraquer illustrates the behavior of air injected into the anterior chamber in eyes with and without vitreous loss, and gives precise indications for the procedure. It is useful to prevent or ameliorate the consequences of inclusion of vitreous fibers in the wound when vitreous is lost, or when a disturbed postoperative relation between the iris and the corneal section is feared. The syringe containing air is sterilized in a glass container. (12 illustrations.) Ray K. Daily.

Barraquer-Moner, J. I. Keratotomy with pneumatic fixation in phacoeresis. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, June, pp. 448-456.

The author's device for making the corneal section in a cataract extraction fixes the entire cornea through a

vacuum, and cuts the limbus perpendicularly to the plane of the iris. The advantages claimed for such an incision are the adequacy of a smaller section, the accessibility of the root of the iris, and the easier introduction of corneoscleral sutures. In complicated cataract with occlusion of the pupil, the posterior synechia are separated from the lens by a spatula introduced through the peripheral iridectomy behind the iris. In occlusion of the pupil the occluding membrane after separation from the lens is perforated with the spatula and one or several small sphincterotomies made at the lower margin of the pupil. This relaxes the rigidity of the iris, and makes room for the manipulation of the suction tip and the delivery of the lens.

Ray K. Daily.

Bujadoux, A. New method of keratotomy and its use in the operation of cataract extraction. Arch. d'Ophth., 1946, v. 6, no. 1, pp. 22-28.

Bujadoux discusses the advantages

and disadvantages of the Gräfe knife incision and the incision with keratome completed by scissors. He has designed a keratome resembling in shape the knife of Barraquer with which the incision can be made in a single motion without the use of scissors. The author's instrument is introduced into the eye at 9 o'clock for the right eye and at 2 o'clock for the left eye, a counterpuncture is made, and the movement continued until the section is completed. Good fixation of the eye is necessary and is accomplished by having the assistant control simultaneously a superior rectus suture and a fixation forceps at the insertion of the external rectus. The operator maintains fixation at 7 or 8 o'clock. The author states that if a conjunctival flap is desired it is possible to obtain one. After the keratotomy has been completed the lens can be extracted by any of the standard procedures.

Phillips Thygeson.

Cordes, F. C., and Barber, A. Changes in lens of embryo after rubella. *Arch. of Ophth.*, 1946, v. 36, Aug., pp. 135-140.

The eye of a 7 to 8-week embryo was obtained through a therapeutic abortion. The mother had rubella during the sixth week of pregnancy. The lens showed definite retardation of development and differentiation, whereas the posterior segment of the eye seemed normal. The author suggests that the absence of the protection of the lids and of Descemet's and Bowman's membranes during the first three months of pregnancy may permit the toxic agent in the amniotic fluid to act fairly directly on the lens during this time. The presence of these barriers after the third month may explain the absence of initial changes in the lens after that time. (2 photomicrographs.)

John C. Long.

Corrado, M. Action of proteolytic ferments on lens substance. *Ann. di Ottal.*, 1946, v. 73, Feb., pp. 91-113.

After summarizing the work of others on the digestive power of trypsin on normal lens substance Corrado presents his own studies of the in vitro action of trypsin on both the normal and cataractous lens. He used human lenses and those of oxen, calves, and rabbits. Sterile trypsin obtained by passage through a Berkefeld filter was used throughout.

The lens capsule was found to be impervious to trypsin. The ferment must have direct access to the lens substance in order to act upon it, and has a slightly greater digestive power on cataractous than on normal lens proteins. Corrado will report later his studies of the possible therapeutic value of trypsin, injected under the conjunctiva or into the anterior chamber, in postoperative lens remains and in traumatic cataract.

Harry K. Messenger.

Daily, R. K., and Daily, Louis. A simple technique for the closure of cataract incisions. *Texas St. J. Med.*, 1946, v. 42, Aug., pp. 284-286.

A conjunctival incision is made 5 mm. from the cornea and the conjunctival flap is undermined to half of the corneal circumference. The flap is reflected to expose the limbus and a 6-0 double armed black silk suture is placed 3mm. in the episclera at the limbus. Section is then made. The two sutures are then passed through the conjunctiva as close to the cornea as possible. The section is enlarged and the operation continued. The suture is tied at the end of operation. The conjunctiva flap is sutured with a running stitch. The suture is water tight. The anterior chamber reforms early. Sutures are removed on the eighth day.

I. E. Gaynon.

Del Rio, G. P. Electric cataract. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, March, pp. 245-252.

An electrician, 36 years of age, was struck by a 5,000-volt current. In addition to general injuries he had enormous hematomas of the lids, with extensive conjunctival chemosis and hematoma. Several months later he developed visual impairment, and was found to have bilateral, subcapsular lenticular opacities. The cataract in the right eye progressed to a complete milky opacity, and that in the left appeared to be stationary. The right eye was operated on and normal vision was recovered. The uncertainty of the prognosis because of possible damage to the fundus, and the relation to industrial compensation is discussed. The literature is briefly reviewed.

Ray K. Daily.

Druault, M. Suture lines of the lens and arrangement of the fibres. *Arch. d'Ophth.*, 1946, v. 6, no. 1, pp. 16-21.

The author reviews the embryology of the lens and discusses the arrangement of the suture lines in various animals and in man. He notes that in the newborn human the lens star has three branches whereas in the adult it may have from six to nine. He describes the entopic images of the lens sutures and their significance. The article is illustrated with thirteen drawings.

Phillips Thygeson.

Garcia Miranda, A. Bilateral cataract extraction. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, April, pp. 344-350.

Garcia reviews the literature. He performed six bilateral extractions, and one eye became infected because of a dacryocystitis which was overlooked. The second eye had good vision. Five patients had good binocular vision.

Ray K. Daily.

Gruber, M. Primary familial dysplasia of the lens. *Ophthalmologica*, 1945, v. 110, July-Aug., pp. 60-72.

This is the report of dominant hereditary formation of a bilateral membranous cataract in two generations of the same family. Three children of a father with this malformation of the lens had the same condition. After reviewing the literature and the various theories on the subject the author stresses the possibility of a primary dysplasia of the epithelium of the lens. He doubts that an intrauterine iritis is the cause of the membrane. Surgery is often difficult owing to the toughness of the membrane and an optical iridectomy may often yield better results than a forced discision or removal of the whole membrane with loss of vitreous.

Max Hirschfelder.

Haro, E. S. Hereditary disk-shaped (ring) cataract. *Arch. of Ophth.*, 1946, v. 35, July, pp. 82-100.

The disk-shaped, or ring, cataract is a rare form of congenital cataract that has been reported relatively few times. The hereditary tendency has been reported in only one family. In July, 1944, a 10-year-old girl with congenital disk-shaped cataracts was brought to the eye clinic of Stanford University Hospital. Her history led to the study of a family, of 59 persons, of whom 16 have the same congenital anomaly.

All the members examined presented the type of cataract known as "disk-shaped," or "ring," characterized by the absence of the lens nucleus. This is due either to a failure of development of the primary fibers (Collins) or to a secondary resorption of the central parts, following an idiokinetic disturbance at an early stage (von Szily). This suggests the presence of genes controlling the development of the

nucleus. Apparently, such genes are dominant.

Association of these cataracts with ectopia lentis was found in all the patients examined. No other local or systemic anomaly was present. (5 illustrations, references.) R. W. Danielson.

Johnstone, I. L. Heat ray cataract. Trans. Ophth. Soc. U. Kingdom, 1944, v. 64, pp. 252-256.

Ten cases of heat ray cataract are reported. The author emphasizes the clinical findings. With a +12 lens in the ophthalmoscope one quickly sees the discrete posterior lens opacity silhouetted against the fundus reflex. With the use of the slitlamp the changes in the anterior lens capsule, the brassy reflex, and the granular appearance of the posterior cortex could be seen. Beulah Cushman.

Knüsel, O. The morphology of an electric cataract. Ophthalmologica, 1946, v. 111, April-May, p. 298.

The disturbance of vision occurred one year after injury with a high voltage current (18,000 Volts). He describes the morphologic characteristics of the cataract, and differentiates it from senile cataract and the cataracts of tetany and myotonia.

Alice R. Deutsch.

Meisner, W. Intracapsular and extracapsular cataract extraction. Revue Bulgare d'Opht., 1943, v. 2, pp. 129-136.

The results of the extracapsular cataract extractions are not greatly inferior to those of intracapsular extractions. The latter are more difficult, there is greater danger of vitreous loss, secondary hemorrhages and late detachment of the retina; the slight postoperative reaction is an advantage of the latter method.

Alice R. Deutsch.

Moreu, Angel. Postoperative hyphemia in cataract extraction. Arch. de la Soc. Off. Hisp.-Amer., 1945, v. 5, June, pp. 467-471.

After a brief reference to the role of trauma in this complication, the author dwells in detail on the ocular metabolism of vitamin C. Experimental toxic or traumatic cataract in dogs in associated with a significant reduction of vitamin C in the aqueous, and an increase in its oxide. The stimulation of the orthosympathetic system by injections of acetylcholine or doryl into the anterior chamber led to the appearance of ascorbic acid in the aqueous. The atropinization of the eye was followed by its disappearance. After extracapsular extraction the vitamin C content of the aqueous is reduced; in intracapsular extraction it is entirely eliminated. These findings may explain the greater incidence of hyphema after intracapsular extraction. On the basis of the experimental data relative to the vitamin C content of the eyes. Moreu urges that the ortho-sympathetic system be stimulated preoperatively, and that massive doses of vitamin C be administered preoperatively, and for ten days postoperatively. Atropine should not be used, and dilatation of the pupil should be obtained through the use of sympathetic stimulants, such as concentrated epinephrine. Ray K. Daily.

Munoz, J. A. Congenital zonular cataract, tetanic cataract, and rickets. Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, March, pp. 253-264.

The literature is reviewed and a family reported, in which the father, five sons; and one daughter had zonular cataracts; the mother and two daughters had normal eyes. All the affected children had dental defects; only one had bony deformities in the hands, which could be attributed to rickets.

One child with normal eyes had chorea. The illustrations show that the form of the opacities was somewhat different in each case, but all were situated in the embryonal and fetal nuclei. Of the seven patients, two were emmetropic, three hypermetropic and two myopic. The anteroposterior axis of the lenses was not shortened; the blood calcium was normal. During a four-year period of observation the opacities were stationary. As the tabulated data show, these cataracts could not be attributed to tetany. The dental defects suggest rickets as the possible etiology probably because of a calcium deficiency in the mother. (2 illustrations, 1 table.)

Ray K. Daily.

Samuels, Bernard. Proliferation of lens epithelium. *Amer. Jour. Ophth.*, 1947, v. 30, Jan., pp. 1-11. (1 color plate, 28 figures, references.)

Schmid, A. E. A contribution to the knowledge of contusion and massage cataract: permanent and transitory types. *Ophthalmologica*, 1946, v. 111, June, pp. 365-371.

The author describes the eyes of a patient with bilateral congenital ectopia lentis. The lens in the right eye was luxated into the anterior chamber and caused considerable increase in tension. The anterior surface of the lens was in contact with the posterior corneal surface and was the site of superficial transitory opacities which were temporarily increased when a needling was tried. The opacities had characteristic marginal indentations and changed their shape or disappeared whenever the lens-cornea contact was interrupted. The localization of the opacities in either the lens capsule itself or the epithelium was very difficult. The author compares the opacities with Vogt's disseminated subepithelial glau-

comatous cataract which is similar in shape but different in localization. This cataract is also a permanent opacity.

The morphologic picture of contusion cataract and of a special type of cataract after massage are similar and characterized by concave marginal indentations. The localization depends on the degree of pressure. According to the strength of the pressure it produces an opacity that is superficial and transient or deep and permanent. (References.)

Alice R. Deutsch.

Schmid, A. E. Light reflexes in spherophakia. *Ophthalmologica*, 1946, v. 111, June, pp. 359-364.

The author describes his own experimental and clinical studies on the origin and nature of the complex light reflexes that occur in spherophakia and microphakia. His patient had a luxation of the lens into the anterior chamber in her right eye and a subluxation of the lens into the vitreous in her left eye. The light reflexes could be observed in different positions of the lens. Whenever the focused pencil of light of the slitlamp reached the lens-equator under a certain angle a small semicircle of light originated on the posterior surface of the lens. In the optimal angle of incidence of the beam a part of the beam was reflected under the surface of the lens back to the point of entrance so that a ring of light encircled the whole lens. This is the phenomenon of total and continuous reflection along the border planes. A colored plate and diagrams elucidate the appearance and origin of these rather complex phenomena. (6 figures, references.)

Alice R. Deutsch.

Smith, D. P. Iridencleisis—a modification. *Brit. Jour. Ophth.*, 1946, v. 30, Oct., pp. 589-590.

On a patient 80 years of age with bilateral chronic glaucoma and cataract and with minimal vision in the better eye, an iridencleisis was done and later a cataract extraction. The first operation was modified so that the subsequent one would not derange the filtering scar. The keratome incision was made about 5 mm. above the limbus and only one iris pillar was incarcerated. The area was covered by a sliding flap of conjunctiva. The cataract extraction was successful and visual acuity was $\frac{5}{8}$. Morris Kaplan.

10

RETINA AND VITREOUS

Ammann, E. Heredity of hemeralopia hereditaria and tapeto-retinal degeneration. *Ophthalmologica*, 1946, v. 112, Aug., pp. 78-87.

A genealogic tree in which 53 blood relatives in five generations and 38 relatives by marriage are charted is described and analyzed. The inheritance in all four generations was direct. There was no interrupted line. Manifestly sound fathers and mothers never had afflicted offspring. The propagation of the disease through afflicted mothers is questionable. The younger offspring in an afflicted family were normal. (1 family tree, references.) F. Nelson.

Appelmans, M. M. Angiomatosis of the retina in the child. *Bull. Acad. roy. de med. de Belgique*, 1945, v. 10, no. 3, pp. 91-119.

The author reviews the history of angiomatosis and reports his observations on the eye of a child, four years of age. He observed the evolution of the disease from the stage of amaurotic cat's eye until enucleation became necessary two years later. He also describes histologic preparations from the

eye. (9 photomicrographs and extensive bibliography.) Jose Saenz Canales.

Arjona, J. The syndrome of Groenblad and Strandberg. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, March, pp. 277-290.

An extensive review of the literature accompanies this report of three cases of angioid streaks and pseudoxanthoma elasticum in women. Most of the patients with this syndrome are men. One of the three patients, 49 years of age, had retinal hemorrhages as well; which caused considerable reduction in visual acuity. The other two patients were sisters, who came because of a mild conjunctivitis; their skin lesions led to the discovery of the syndrome. Their fundus lesions were slight, and vision was unimpaired. (3 illustrations.) Ray K. Daily.

Arruga, H. The fundus of the new-born. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Oct., pp. 835-839.

Arruga points out the importance of familiarity with the appearance of the fundus of the new-born, in order not to make erroneous diagnosis and prognosis. Retinal hemorrhages are frequent in the new-born; they occur during parturition and are always absorbed within a few weeks, without leaving traces. The optic disc may appear grayish white, with hazy borders, suggestive of a mild optic neuritis. This appearance is due to the delayed retrogression of myelin, which impregnates the nerve fibers at the level of the lamina cribrosa. At 10 or 12 months of age the optic disc assumes a normal appearance. (5 colored fundus drawings.) Ray K. Daily.

Arruga, H. Detachment of the retina. *Arch. de Ophth.*, 1946, v. 36, Nov., pp. 531-536.

This is a "must" article for those interested in retinal detachment surgery. Every sentence is significant. A few outstanding statements follow.

Gonin's demonstration that retinal detachment is cured by sealing the retinal tears clarified and oriented the previously vague conceptions of the etiology, pathogenesis, and therapy of this process.

Detailed studies of the ocular fundus and histologic examinations of enucleated eyeballs have demonstrated that in idiopathic detachment the retina is much altered. It is strange that retinal detachment is not of more frequent occurrence. In histologic studies, atrophic and degenerative lesions reduce the thickness of the retina to one-third normal. In 18 years Arruga has observed more than 40 cases of retinal holes without detachment.

In order that the retina may become detached, the margins of the tear must be inverted slightly toward the interior of the eye, so that the vitreous strikes against them with movements of the eyeball.

The retina does not become detached if it is adherent to the choroid as well as to the framework of the vitreous. For this reason, chronic and degenerative processes are more likely to predispose to retinal detachment than are intense chorioretinal inflammatory processes.

Trauma as the determinate cause of retinal detachment does not have the important role which has been conceded to it in the past. Retinas do not become detached unless they are diseased, except after extensive traumatism. More frequent causes are a blow on the cranium, a fall on the heels, sneezing, coughing and, above all, excessive stooping.

The fundamental concept of the

movements of the eyes as the factor which initiates and increases the detachment is becoming more definite, but the varieties of its evolution show that other factors are also important. One known factor of influence is the size of the retinal rent. When the tear is small, there is rapid resorption of the subretinal fluid; when the hole is large, resorption is slow. The rapid formation of large tears indicates extreme friability of the retina or the existence of extensive adhesions between retina and vitreous, which render treatment ineffective. The factor of time, which used to be considered of such importance and which enhanced the urgency of operation, is being disregarded. The urgency in most cases does not lie in surgical intervention so much as in the need for bandaging the patient's eyes and enforcing relative repose.

Another of the factors which has most influence on the evolution of the retinal detachment and on its cure is the condition of the choroid. A detachment which is replaced with rest has a good prognosis, for the choroid is demonstrated to be in good condition for reabsorption. The vitreous acts as a foreign body on the choroid, which is finally destroyed. For this reason, all retinal detachments of more than two years' duration are accompanied by complete atrophy of the choroid. Consequently it is advisable to localize the diathermic action as much as possible. A thorough study of the fundus is necessary so as to avoid lavish use of diathermy over an extensive area. Immediate repetition of the operation is advisable only when tears appear which were not reached by the preceding diathermic action. R. W. Danielson.

Azcoaga, J. M. Retinal arterial tension in general hypertension. Arch. de

la Soc. Oft. Hisp.-Amer., 1945, v. 5, July, pp. 519-557.

The author presents a detailed physiologic study of the retinal circulation. He uses the Bailliant's ophthalmodynamometer. The study of the retinal arterial pressure is very useful in determining the stage of development of general hypertension. The retinal circulation is under greater pressure than would be suspected from the sphygmomanometric reading. The fundus picture does not necessarily correspond to the type of hypertension; since plethoric patients show consistently fewer changes, two types of hypertension, red and pale, must be distinguished. Renal and essential malignant hypertension cannot be differentiated. (14 illustrations.) J. W. McKinney.

Bailliant, P. Lectures on the vascular pathology of the retina. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, Oct., pp. 898-911.

This is a condensed summary of Bailliant's lectures. Emphasis is placed on the fact that the retina is an extension of the brain, and the retinal blood vessels are subject to the same regulations as the cerebral vessels. The examination of vascular retinal pressures is described and the value of ocular capilloroscopy to the internist and the neurosurgeon made clear.

The etiology of arterial hypertension, and its ocular symptoms are discussed in detail; among the early symptoms are cloudiness of vision, and the need for increased illumination for near work. The fundus at this time shows edematous areas in the form of striae or points, arteriovenous compression, and punctate obliteration of some of the capillaries. If the retinal arterial tension is higher than half the brachial pressure, it is indicative of parietal

hypertension; if it is lower, it indicates obstruction below the level of the retinal vessels; in either case it means a disturbance in the cerebral circulation, and a disparity between the retinal and humeral pressures is a poor prognostic sign. Hypertension without these retinal changes is relatively benign, and is well tolerated.

For a clinical prognosis the examiner should note hyaline degeneration, capillary failure, the state of the conjunctival vessels, the results of entoscopic examination, and the state of the arterial retinohumeral pressures. A retinal arterial tension higher than half the brachial indicates retinal angiospasm, and also cerebral and renal angiospasm. A retinal arterial tension lower than normal indicates failing cerebral circulation, and such patients are apt to suffer hemianopsia or hemiplegia, even in the absence of obvious cardiac or renal changes.

In malignant hypertension, which the ophthalmologist encounters in one percent of cases, and which is due to capillary inadequacy the first signs are arteriovenous compression, followed by hemorrhages and edema at the posterior pole. Particularly grave are those which set in with thrombosis of the central retinal vein. It is really a collapse of the venous walls, rather than a true thrombosis. Retinal degeneration follows, with profound macular changes due to a disturbance in the choriocapillaries. Such changes in the retina indicate that similar processes are taking place in the higher cerebral centers. Ray K. Daily.

Bailliant, P. The retinal capillaries. Revue Bulgare d'Ophth., 1943, v. 2, pp. 34-43.

The anatomy of the retinal capillaries is described. They are ophthal-

moscopically invisible but can be examined by means of the capillaroscopy of Fortin and the endoptoscopy of Scherer. He discusses these methods in detail and stresses their importance for a better understanding of the retinal capillaries in health and disease.

Alice R. Deutsch.

Bischler, V. Pigmentary retinitis following measles. *Confinia Neur. Basek*, 1944-45, v. 6, no. 5, pp. 270-277.

The author reviews the literature and adds a case of pigmentary retinitis following measles. The condition is rare and may occur with any exanthemata. Sudden amaurosis occurs about the fourth to eleventh day of measles and is followed by slight recovery of vision. There is attenuation of the retinal blood vessels, and the fundus picture may resemble that of embolus of the central artery of the retina. The tapetoretinal degeneration appears several months or years after the acute condition. The retina may have scattered masses of pigment, a fine pigmentation, and small yellowish-white spots. At first it is progressive, then remains stationary, in contrast to the slow progression to blindness of retinitis pigmentosa.

Orwyn H. Ellis.

Bishay, A. Quinine amblyopia. *Brit. Jour. Ophth.*, 1946, v. 30, May, pp. 281-287.

The author presents seven cases of quinine amblyopia after reviewing the theories of its etiology. The two predominant theories are a direct toxic effect on retinal cells and an anemia of the retina caused by extreme constriction of retinal vessels due to the quinine. The author concludes that whatever else is involved, a personal sensitivity to quinine must certainly be a factor. In his treatment, large doses of strychnine and paracentesis were em-

ployed with better than average results. (4 diagrams.)

Morris Kaplan.

Brückner, A. The X-ray treatment of the retinoblastomas. *Revue Bulgare d'Ophth.*, 1943, v. 2, pp. 55-63.

A child, 15 months of age, is described who had advanced bilateral retinoblastoma. After the enucleation of the worse eye the other was given intermittent doses of X rays. After temporary regression of the tumor, there was a massive recurrence, secondary glaucoma, and orbital metastasis.

Alice R. Deutsch.

Ciotola, Guido. Further observations on heparin treatment of thrombosis of the central vein of the retina. *Boll. d'Ocul.* 1945, v. 24, Jan.-March, pp. 35-51.

In addition to the report published in the January 1941 issue of this periodical on a new treatment of this form of thrombosis by heparin the author now reports 35 more cases. A short history is given of each. The age of the patients ranged from 36 to 78 years. The thrombosis was total in 16 patients. The treatment was started from 2 to 90 days after the onset of the disease and the duration of treatment was 10 days, rarely longer. In five patients the vision remained stationary and in the others it deteriorated. A re-examination of 21 patients after one year showed still better vision in nine and further deterioration in five. The fundus examination showed a partial absorption of hemorrhages. The rapid improvement of vision during the treatment was due to a reduction of retinal edema as a result of the improved venous circulation. The treatment caused no secondary disturbance other than a transient rise of temperature in a few patients.

Melchior Lombardo.

Cornet, E. Retinopexies. *Ann. d'Ocul.*, 1946, v. 179, Feb., pp. 112-118.

Retinopexies are surgical procedures for relief of retinal detachment. They produce an adhesive chorioretinitis limited to the zone surrounding tears or generalized detachments; and affect vitreous pressure. Surgical treatment should occlude small tears, include the entire zone involved, and exclude the extension of the detachment. Because of its simplicity and uniformity in producing solid cicatrices, galvano-cautery is preferred to diathermy. Cauterization of the vortex veins will result in severe hemorrhage. Retro-retinal cystic degeneration may be primary or secondary and is more frequent than is usually believed. It occurs in 50 percent of retinal detachments in patients under the age of 40 years. Destruction of the cyst is considered essential for the permanent cure of detachments. If pockets of suprachoroidal fluid exist far from a tear, a supplementary perforating puncture is made in the affected area. For hypotension subconjunctival injections of 1/1000 solution of mercury cyanide in 5 to 10-percent sodium chloride solution is used. If the vitreous is retracted scleral resection should be considered. In detachments with tears, Gonin's operation or one of its modifications is advised. In generalized detachments the operations of Weve-Sichel, or de Wecker-Soudielle are preferred. The author's nonperforating sclerocyclectomy for vitreous retraction includes an annular excision of a 2 to 3-mm. band of sclera near the ora serrata with corresponding resection of the anterior ocular muscles.

Chas A. Bahn.

Dominguez, D. D., and Girones, E. A. Recurrent edema of the macula. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Jan., pp. 38-54.

An exhaustive review of the literature, and a report of four cases are presented. The author believes in the identity of this affection with that described by Horniker as chorioretinitis centralis serosa. It is probably as frequent in Europe as in Japan, and the diagnosis is often missed because of inadequate attention to the subjective symptoms, and of failure to make a detailed examination of the macular region. Etiologically it is similar to angioneurotic edema, perhaps allergic in origin. In spite of the frequent recurrences the prognosis is favorable. (2 illustrations.)

Ray K. Daily.

Esente, Ivan. Diabetic retinosis, simple and complicated. *Riv. di Oftalm.*, 1946, v. 1, April, pp. 249-277.

In addition to an extensive review of the literature, the author discusses his own observations that suggest the clinical importance of distinguishing between the ophthalmoscopic and pathogenetic characteristics of "simple" and of "complicated" diabetic retinosis. Neurohormonal disturbances, probably originating in the hypophysis, may initiate simple diabetic retinosis in the absence of hypertension as well as hyperazotemia. Therapeutic indications may be derived from this ophthalmoscopic differential-diagnostic clue.

K. W. Ascher.

Falcone, G. A case of juvenile disciform macular degeneration. *Indian Med. Gazette*, 1946, v. 81, June-July, pp. 241-242.

This non-inflammatory disease occurs during the second and third decade of life and tends to resolve in a few months. The exudative mass has degenerative rather than inflammatory characteristics. Coats' disease, tubercle, and malignant melanoma are to be differentiated from it. In the author's pa-

tient, a European male, aged 29 years, the disease affected one eye and later the other and healed completely.

F. M. Crage.

François, J. Treatment of thrombosis of the retinal veins by heparin. *Bull. de la Soc. Belge d'Ophth.*, 1945, no. 82, Nov. 25, pp. 19-23.

The author discusses the formation of thrombosis in the retinal veins after trauma or inflammation, and believes that the use of heparin in these cases is justifiable. Heparin is the principal anticoagulant of the animal organism and since it inhibits thrombin formation, it is indicated in these cases.

Heparin was given to 17 patients; the thrombosis was located in the central vein in 12 of these and in five was located in one of the branches. For a period of 10 consecutive days heparin is injected intravenously every six hours. Eighty milligrams are given for two to three days, then 50 milligrams until a total of two grams is given.

A complete cure resulted in seven of these patients whose clinical records are presented in detail.

M. R. Cholst.

Gordon-Napier, G. An electrolysis apparatus devised for retinal detachments. *Brit. Jour. Ophth.*, 1946, v. 30, Aug., pp. 478-485.

The author describes the trials of procuring the parts and assembling an electrolysis machine in India during the war. The equipment was make-shift and the needles were ordinary sewing needles but the finished product served well for three years. Of 24 detached retinas, 12 were attached successfully at first operation, 4 after a second operation, and 8 remained defective. (4 diagrams.)

Morris Kaplan.

Gruber, M. Histologic findings in the fundus in Fahr's nephrosclerosis. *Ophthalmologica*, 1944, v. 107, Jan.-Feb., pp. 87-90.

The vessels of the choroid in Fahr's nephrosclerosis are similar to those of the kidneys. There are thickening of the intima and media and very few inflammatory processes. There were excrescences of the pigment epithelium protruding into the rod and cone layer of the retina.

Max Hirschfelder.

Hagedoorn, A. Instrument for locating retinal ruptures during operation. *Arch. of Ophth.*, 1946, v. 36, Aug., pp. 225-226.

This instrument is designed for the scleral transillumination of the globe. A minute light is enclosed in a metal tube which is affixed to the globe by teeth. A metal wing is attached to the tube to aid in manipulation and as an indicator of the position of the light. It is used in the same manner as the Goldmann instrument. The author describes its use in the localization of retinal tears and of scleral foreign bodies. (2 illustrations.)

John C. Long.

Halbron, P., and Rozan, A. Five cases of macular lesions of undetermined etiology. *Ann. d'Ocul.*, 1946, v. 179, March, pp. 131-137.

Five patients with vision from 20/40 to 20/20 had irregularity of macular pigment, diminution of macular reflex, and slight retinal opacity as the only pathologic findings. Practically all had had nutritional deficiencies as prisoners of war. None had received direct injuries.

Chas A. Bahn.

Hall, G. S. The ocular manifestations of tuberous sclerosis. *Quart. J. Med.*, 1946, v. 15, July, pp. 209-220.

Frequent ocular manifestations of

tuberous sclerosis are retinal nodules (phakomata) of which there are two types. In one type small, greyish-white, single or multiple nodules occur in any part of the retina; in the other type a large mass usually develops in the region of the optic disc, projects into the vitreous, is frequently cystic, and may produce optic nerve atrophy. The nodules are usually avascular and may be associated with alterations in the blood vessels. The lesions are composed almost entirely of glial cells, and primitive fibers. There is a whorl-like arrangement of cells with brush-like areas of gliosis. Cystic degeneration may or may not be present. The lesion can become a true blastoma.

Rarely nodules may occur in the lens and cause opacity. Histologic findings in such an eye after post-mortem are presented.

Orwyn H. Ellis.

Krause, A. C., and Sibley, J. A. *Metabolism of the retina*. Arch. of Ophth., 1946, v. 36, Sept., pp. 328-348.

This monograph on the metabolism of the retina discusses the subjects under the headings of hydrogen-ion concentration, organic phosphate, oxidation-reduction potential, respiration and glycolysis, anoxia, general metabolism, respiratory quotient, fat metabolism, formation of ammonia, glycogen, carbon dioxide anhydrase, acetylcholine, and detached retina.

R. W. Danielson.

Lemoine, Albert N., Jr. *Retinoblastoma*. Amer. Jour. Ophth., 1947, v. 30, Jan., pp. 52-55.

Lipkina A. I. *Tissue therapy of retinitis pigmentosa*. Oftal. Jour. (Odessa), 1946, pt. 2, pp. 29-33.

Verbitskaia reported favorable results in 77.3 percent of 110 patients

treated according to the Filatov method which consists of intramuscular injections of cod liver oil, subconjunctival implantation of placental tissue, subcutaneous implantation of placenta and preserved skin. In this study the procedures used were subcutaneous injections of a specially prepared extract of leaves of aloes, kept on ice in darkness for 15 days; implantations of preserved and autoclaved cadaver and animal skin; and a combination of the two procedures.

Of the 30 patients in this study 22 were under observation less than six months, and four for one year. Almost all of them had advanced lesions. Sixteen patients were treated with an aqueous extract of leaves of aloes. The favorable effect of therapy was manifested by an increased visual acuity, extended visual field, improved reading ability, and improved dark adaptation. Only one patient was unimproved. In one patient vision rose from imperfect light projection to 0.1, and in the other from 0.01 in each eye to 0.3 and 0.2. Thus, a patient with total visual disability recovered the ability to work, read, and write. This experience justifies the assumption that the improvement would be even greater if treatment were applied early. Two tables give brief summaries of the treatment.

Ray K. Daily.

Longhena, Luisa. *Light perception in detached retinas*. Riv. di Oftalm., 1946, v. 1, April, pp. 225-244.

Painstaking study of dark adaptation was performed on twenty patients suffering from retinal detachment. Campimetry at reduced illumination was also done using a perimeter of long radius and white, red, and green targets. For the adaptation test, Birch Hirschfeld's instrument was used.

After exposure to bright light for ten minutes, the eye was tested every three minutes during a period of forty minutes. In nine of the patients operation seemed to be contraindicated and in one a spontaneous recovery of the detachment occurred. Ten eyes were operated on and in seven of these there was complete restitution. One showed some postoperative improvement, one relapsed, and one became worse after the surgical intervention. Three weeks after the operation no adaptation was present in the detached parts of the retinas. It returned, however, if surgical or spontaneous recovery occurred. It took a varying period of months to redevelop. It is important to stress that the retinal pigment layer probably plays the main role in dark adaptation. In spite of the fact that it is in physical contact with the reattached inner retinal layers, it does not start to function immediately. A certain period of time is necessary to overcome an unknown organic or functional disturbance of the pigmented retinal epithelium.

K. W. Ascher.

Maggiore, Luigi. The functional relations between the pigment epithelium and the neuroepithelium of the retina. *Revue Bulgare d'Opht.*, 1943, v. 2, pp. 113-128.

This paper represents a detailed clinical, pathological, biochemical and physiological study of the importance of close contact between the pigment epithelium and the neuroepithelium for the maintenance of perfect visual function, especially, in relation to various forms of retinal detachment.

Alice R. Deutsch.

Matas, B. C. Retinitis punctata albens. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, March, pp. 269-276.

The case reported occurred in a 30-year-old man with inadequate dark adaptation since childhood. He had no consanguineous antecedents. Ten of his 19 siblings were living, and all had a history of the same disturbance, which, however, disappeared when they reached the age of twenty years. The patient noted a progressive impairment of vision during the last three years, with increasing difficulty in reading, particularly of red or blue letters. The fundi contained disseminated white points, particularly numerous at the posterior pole. The foveal reflex was absent in both eyes. There were no pigment changes. Vision was reduced to 1/10. The fields were normal. The literature on the subject is briefly reviewed, and the need for therapeutic research is emphasized. (Visual fields.)

Ray K. Daily.

Mosquera, Sanchez. Two cases of retinal disinsertion. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Sept., pp. 803-805.

Sanchez reports two cases of slowly developing retinal disinsertion in young men, in good general condition; the patients were not myopic and there was no history of trauma or infection. The vitreous, the ciliary body, and the lens showed none of the changes frequently found in old retinal detachments. Both were cured by diathermy coagulation. The slow evolution of retinal disinsertion is explained by the fact that the vitreous does not seep through as easily when there are no retinal holes and disinsertions usually occur in eyes with healthy vitreous. The organic integrity of the eye accounts for the better prognosis. This type of disinsertion with a characteristic clinical course is attributed by the author to cystic degeneration of the retinal periphery caused by embryologic malformation or consecu-

tive to an intraretinal hemorrhage that occurred during gestation or as a result of obstetric trauma. (4 illustrations.)

Ray K. Daily.

Nastri, Francesco. Further researches on pathogenesis of diabetic retinitis. *Boll. d'Ocul.*, 1945, v. 24, Jan.-March, pp. 19-34.

The writer studied the behavior of vitamins A and K in the blood of patients affected by this retinal lesion and came to the conclusion that in these cases hepatic disfunction must not be excluded from consideration. (Bibliography.)

Melchiorre Lombardo.

Pickard, R. The perioptic atrophic ring. *Brit. Jour. Ophth.*, 1946, v. 30, Aug., pp. 437-445.

These atrophic rings that are occasionally seen around the optic disc are frequently associated with glaucoma, cavernous atrophy, and retinal sclerosis. The study was made on 826 consecutive patients over 50 years of age. Most of the patients exhibited unmistakable narrowing of the retinal vessels in almost direct ratio to the amount of the atrophy. The author assumes that this narrowing is primarily found in the vessels of the circle of Zinn. (4 tables.)

Morris Kaplan.

Pines, N. Diagnostic and clinical value of some forms of retinal angiospasm. *Brit. Jour. Ophth.*, 1946, v. 30, Aug., pp. 470-476.

Painstaking exploration of the retinal arteries in the red-free light of a Wolf ophthalmoscope sometimes reveals local constrictions of the lumen. The significance of this local angiospasm only becomes clear when the findings are correlated with careful oscillometric studies of the vessels of the arms and legs. It will be found that they are an

index of the state of general angiospasm and of some value in prognosis.

Morris Kaplan.

Rubino, A. Retinal detachment with disinsertion due to a large intraretinal cyst. *Riv. di Oftalm.*, 1946, v. 1, March, pp. 149-155.

Weve distinguishes three kinds of retinal cysts: those without a retinal detachment, those secondary to a detachment, and those causing a retinal detachment. A case of the latter type is described. A man, aged 38 years, had an extensive retinal detachment involving the temporal lower retinal quadrant of his left eye with a disinsertion extending along the periphery from the 4-o'clock to the 7-o'clock position. In the lower nasal quadrant, the convex border of an enormous retinal cyst was visible two disc diameters from the papilla; its distal border was invisible. Operation consisted of transcleral diathermy coagulation; a double barrier coagulation was performed along the disinsertion, and finally, the cyst was evacuated by perforating diathermy. Reattachment of the retina and collapse of the cyst became permanent. Final vision was 0.1 because of a small central field defect whereas the peripheral field was only slightly constricted in the nasal upper quadrant. A pigment line indicated the outlines of the collapsed cyst. The author advocates the use of the perforating type of operation only in cases characterized by large retinal cysts.

K. W. Ascher.

Schneider, R. W., Lewis, L. A., and McCullagh, E. P. Plasma proteins. I. Alteration in diabetic retinitis. *Am. J. M. Sc.*, 1946, v. 212, Oct., pp. 462-465.

Clinical and biochemical studies were made in 31 cases of diabetic retinitis to determine a relationship between cer-

tain alterations in the plasma proteins and retinal changes and to determine whether a high intake of protein would change either or both of these disorders.

In inadequately treated diabetes mellitus one frequently finds typical changes that consist of a reduced level of albumin and an increase in B globulin. The total protein may be normal or slightly reduced. Unless such complications as infection, renal insufficiency, or particularly retinitis exist, the plasma protein level can be restored to normal. Where renal disease accompanies the retinitis, the plasma protein abnormalities can not always be corrected.

The diabetic retinitis in the male patients was not recognized until diabetes had been present from 12 to 25 years and in women in from 2.5 to 22 years. Four patients showed improvement. In two of them practically all the form and color field defects disappeared in a few months. Subjective visual improvement occurred in two patients. The greatest improvement in retinal changes occurred in those in whom the high protein intake restored the plasma protein to normal. High protein diabetic diets are valuable as an adjunct in the prevention and treatment of diabetic retinitis. Francis M. Crage.

Stallard, H. B. Retinal detachment due to war trauma. *Brit. Jour. Ophth.*, 1946, v. 30, July, pp. 419-429.

An analysis of 96 cases of retinal detachment that occurred in a field force is made; of these only 20 resulted from war injuries. Most of these 20 had serious ocular wounds and retained foreign bodies as well as the retinal separation. In one eye in which the retina was separated in three quadrants without a tear spontaneous reat-

tachment occurred and the vision became normal. A second less extensive detachment also healed spontaneously. Seventeen eyes were operated upon, 11 successfully. (3 illustrations.)

Morris Kaplan.

Stallard, H. B. Bilateral symmetrical cystic detachment of the retina. *Brit. Jour. Ophth.*, 1946, v. 30, Sept., pp. 547-548.

Two young patients presented almost identical bilateral, symmetrical, cystic, retinal detachments, all in the upper temporal quadrant. All were symptomless and were discovered during routine examination. All eyes were otherwise perfectly normal. One retina became reattached spontaneously and the others were operated upon by a single application of surface diathermy followed by a single puncture with the diathermy needle. Postoperative recovery was uneventful and complete. (2 illustrations.) Morris Kaplan.

Streiff, E. B. The modification of the retinal arterial tension in different positions of the body and head. *Revue Bulgare d'Ophth.*, 1943, v. 2, pp. 151-156.

The retinal arterial blood pressure does not change with the position of the head and body under normal conditions but does so in retinal hypertension and hypotension. Alice R. Deutsch.

Wagner, H. Changes in the fundus in Fahr's nephrosclerosis. *Ophthalmologica*, 1944, v. 107, Jan.-Feb., pp. 83-86.

Malignant nephrosclerosis is usually characterized by a severe arteriolosclerosis with necrosis and endarteritis obliterans in the kidneys. It is the end result, when the purely vascular "red" hypertension changes to the "white" toxic hypertension due to the disturbed

kidney function. Clinically it is characterized by intracranial pressure, insufficiency of the kidneys, vascular hypertension (especially the diastolic pressure), loss of weight, uremia, and fundus changes. Fahr distinguishes a still more fulminant nephrosclerosis from the classical picture described above. It affects younger people, is extremely malignant, and is based on exogenous, toxic and infectious influences. One finds necrotic and endarteritic processes in the kidneys similar to the periarteritis nodosa of Kussmaul. The author hopes that ophthalmoscopy may make the differential diagnosis possible which otherwise can only be assumed. He found, aside from the usual ophthalmoscopic findings of malignant hypertension, unusual pigment spots, partly surrounded by a small white area in patients who were later found to have Fahr's nephrosclerosis. Although he is not certain that the finding is constant, he believes it to be an important one. (2 photographs.)

Max Hirschfelder.

Weber, E. The anterior barrier of the vitreous. The spontaneous detachment of its lenticular plica in senility—a new slitlamp diagnosis. *Ophthalmologica*, 1944, v. 107, Jan.-Feb., pp. 108-115.

The author distinguishes a free plica of the vitreous lamella (in the region of the zonula) from that part of the anterior vitreous which covers the posterior surface of the lens as a so called "lenticular plica." Ordinarily, it is impossible to see it with the slit lamp. In young people it is rather firmly adherent to the lens itself and only the strong force of serious injuries will lead to its partial detachment. A different situation is found in people of advanced age. In such people a mild trauma may produce a total detachment of the len-

ticular plica of the anterior vitreous. Myopia also predisposes to such a condition. The fact that this plica is much more easily detachable in elderly persons explains the relative ease of intracapsular extraction in such persons as compared with the same method applied to young patients. (14 illustrations, partly colored.)

Max Hirschfelder.

Weekers, R. The role of light in the pathogenesis of essential detachment of the retina. *Bull. de la Soc. Belge d'Ophth.*, 1945, no. 82, Nov. 25, pp. 29-34.

Cases of detachment of the retina were studied for a period of 15 years at the University Clinic at Liège. Retinal detachments secondary to neoplasm, inflammation, operation, or trauma were disregarded. There were 208 idiopathic detachments. In the majority, predisposing factors such as myopia and arteriosclerosis, with or without hypertension, were found. A graph is presented which reveals an increase in the frequency of affection from March to July and a decrease from July to February. The summer and spring revealed an incidence of 31 percent and 30 percent respectively, which decreased to 21 percent in the autumn and 18 percent in the winter.

The author feels that strong light could produce a tear in a retina predisposed by arteriosclerosis or myopic choroiditis. He believes that the problem could be studied experimentally in a dog with renal ischemia and hypertension (Goldblatt kidney) by exposing the eye of such a dog to strong light.

Weekers urges the use of tinted and dark glasses during the sunny periods of the year as a prophylactic measure for predisposed individuals.

M. R. Cholst.

11

OPTIC NERVE AND TOXIC
AMBLYOPIAS

Alm, Inguar. Primary tumors of the optic nerve and their relation to Recklinghausen's disease. *Acta Pediat.*, 1945, v. 32, no. 3-4, pp. 262-269.

The author presents two cases of primary tumor of the optic nerve in children and discusses the relationship between Recklinghausen's disease and primary tumors of the optic nerve. He supports the view that neurofibromatosis is a disease of nerve cells and axis cylinders and secondarily causes proliferation of the surrounding supporting and protective tissues. The family of one of the patients exhibited manifestation of neurofibromatosis in three successive generations. The other patient had a primary tumor of the optic nerve and neurofibromatosis of the hip. (12 figures.) I. E. Gaynon.

Dell'acqua, G., and Poppi, U. Neuro-myelitis optica. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, no. 1, pp. 1-21.

A woman, 20 years of age, with an acute paraplegia, hypoaesthesia from the axillae down, bilateral choked discs and central scotoma died two months after onset of her disease, from bronchopneumonia. The lower part of the thoracic and the upper part of the lumbar spinal cord showed complete destruction of the nervous tissue. Above and below this region, disseminated lesions of demyelination, necrosis, but no proliferation of neuroglia or perivascular infiltration were found. Secondary degeneration of Goll's column was present, the brain and cerebellum were free, and the optic nerves, when stained with Weigert's solution, showed paleness of their marginal fascicles, pial thickening, and an increased number of nuclei in the interfascicular tissue.

Thus, an acute medullary necrosis was associated with an optic neuritis. The lesions had a different clinical course and a very different pathologic explanation. The combination should not, in the opinion of the authors, be considered a definite clinical syndrome. (11 figures.) K. W. Ascher.

Diez, M. A. Acute epidemic papillitis. *La Semana Méd.*, 1946, v. 53, Sept., pp. 509-534.

The author describes six cases that occurred in children. The record is intended to supplement ten cases reported by Carrillo in a paper read before the First Pan-American Congress of Neurology, Montevideo, 1944. It is suggested that these cases are the expression of acute arachnoiditis possibly due to a neurovirus. (26 illustrations, including visual fields and poorly printed fundus photographs.)

W. H. Crisp.

Freeman, J. D. J. Quinine amblyopia. *Brit. Jour. Ophth.*, 1946, v. 30, June, pp. 345-349.

A woman, 27 years of age, who had been given 120 grains of quinine because of malaria began to complain of deafness and black and green spots before her eyes. No more of the drug was given but in six days she began to complain of blurred vision which progressed to complete blindness in two more days. The pupils were large and fixed, the retinal arteries were constricted, the disc margins blurred, and there was one large retinal hemorrhage. Without specific treatment the vision very slowly returned to normal except for a slight defect in the lower portion of the field in each eye.

Morris Kaplan.

Garcia Miranda, A. Inverted Foster-

Kennedy syndrome. *Ophthalmologica*, 1946, v. 112, Aug., pp. 72-77.

A patient is described who had temporal atrophy of the disc and central scotoma in the left eye and papillary edema with normal vision in the right. A frontal meningioma situated in the right premotor region had displaced the ventricular system in a direction diametrically opposite to the tumor and had pressed the brain against the contralateral optic nerve. This rare condition, only described once before, may be called an inverted Foster-Kennedy syndrome. (2 figures.) F. Nelson.

Guha, G. S. A case of quinine amblyopia. *Indian Med. Gazette*, 1946, v. 81, June-July, pp. 238-241.

A robust Hindu, aged 28 years, complained of tinnitus quickly followed by deafness and loss of vision after the administration of 60 grains of quinine for malaria within a period of 24 hours. The vision was reduced to light perception. The pupils were dilated and fixed, the discs very pale, the retinal arteries threadlike, and the fields were very markedly contracted. Treatment included amyl nitrite inhalations, belladonna, lumbar puncture, corneal paracentesis, and vitamins. Paracentesis gave greatest relief. The vision returned to normal but some peripheral scotoma remained. (Fields, charts.)

F. M. Cragg.

Humblet, M. and Weekers, R. The diagnosis of tobacco amblyopia. *Bull. de la Soc. Belge d'Opht.*, 1945, no. 82, Nov. 25, pp. 53-64.

The authors have noted an increase of 3.4 percent in the incidence of tobacco amblyopia in the period of the war years, 1940-1945, compared to the period from 1930-1940. Among the 66 cases studied during the later period,

certain findings were noted. The affection was bilateral and the defects were symmetrical. The scotomas were centrocecal and not pericentral. The scotomas were best found with smaller test objects. The visual defect was much greater for a red test object than for a blue test object of the same size. Occasionally the centrocecal scotomas were perceived by the patients themselves as black spots. A very careful examination is required when tobacco amblyopia exists in conjunction with other ophthalmic conditions, such as, immature cataract, senile macular degeneration, and high myopia with choroiditis. M. R. Cholst.

✓ Koverzhenko, A. C. Fifty cases of retrobulbar neuritis caused by methyl alcohol poisoning. *Oftal. Jour.* (Odessa), 1946, pt. 2, pp. 38-42.

The following are conclusions based on clinical experience with fifty patients. The end result of methyl alcohol poisoning depends on the promptness of therapy. Repeated venesections followed by blood transfusions, and intravenous injections of normal salt, and glucose solutions are most effective. Lumbar punctures should be performed repeatedly during the first week. In the second week therapy should be directed towards arresting the incipient atrophy of the optic nerves, and should consist of hot baths and retrobulbar injections of atropine and strychnine. Inhalations of amyl nitrite twice daily for 15 days are of value early in the disease but later they are ineffective. Vitamin B should be used. The prognosis is poor when the initial loss of vision remains without improvement for a long time. Patients with optic atrophy caused by methyl alcohol should remain under ophthalmologic observation for a long time.

Improvement of the peripheral field has followed energetic therapy in patients treated two months after the ingestion of methyl alcohol.

Ray K. Daily.

- ✓ Moore, D. F. Nutritional retrobulbar neuritis. *Lancet*, 1946, v. 2, Aug. 17, pp. 246-248.

Retrobulbar neuritis has been one of the most common nutritional diseases in prisoners-of-war and internees in the Far East. The most outstanding deficiencies were those of the vitamin-B complex. Thiamine, though it could cure and prevent beriberi, could neither prevent nor cure the neuritis. Decreased visual acuity is the most common complaint, and partial optic atrophy the commonest fundus finding. Because of the variation, the term "nutritional optic neuropathy" is used. Marmite and dried brewers yeast, were used therapeutically and were effective if used early and in large doses. The neuritis can be differentiated from beriberi, though it can be associated with it. (3 figures, references.)

Bennett W. Muir.

- ✓ Morone, Giuglio. A typical craniofacial dystocia associated with atrophy of the optic nerve. *Arch. di Ottal*, 1946, v. 50, March-April, pp. 45-73.

Morone describes one case of Crouzon's disease, with bilateral optic atrophy. The signs were typical except that the strabismus in this patient was convergent and not divergent. Many other associated lesions have been reported: chorioretinitis, increased tortuosity of vessels, retinitis, pigmentosa, retinitis proliferans, and congenital cataract. The one common ocular finding is the optic atrophy, usually of a gray-green color, dilated sinu-

ous veins, narrowed arteries, and occasionally perivasculitis.

Morone accepts the theory that the basic disturbance is in the lymphatic tissue of the rhinopharynx, in an endocrine imbalance, and in the teratomatous development described by Crouzon. He discards all other theories. The increased intracranial pressure, which is the cause of the many complications must be reduced. Repeated lumbar punctures are purely palliative. Cranial decompression has given good results when done early.

Francis P. Guida.

- Scullica, F. A primary tumor of the sheaths of the optic nerve. *Ann. di Ottal.*, 1946, v. 73, April, pp. 193-206.

A tumor from the orbit of an 11-year-old boy was found to be a diffuse meningioma of the pia-arachnoid of the optic nerve. The cellular elements were typical fibrillar astrocytes. The nerve, which the tumor surrounded as a muff, was normal except for moderate edema and slight degenerative changes.

Harry K. Messenger.

- Seidenari, Renato. Leucosarcoma of papilla in a luetic patient. *Boll. d'Ocul.*, 1945, v. 24, April-June, pp. 152-162.

A man, 58 years of age, who for about a year had noticed a progressive diminution of vision of his right eye had a visual acuity of 1/100, negative transillumination and normal intraocular tension. The fundus examination revealed a round grayish mass occupying the entire region of the disc and protruding into the vitreous for 3 mm. A previous examination had shown a positive Wassermann reaction but anti-luetic treatment had not affected the mass in any way. A diagnosis of neoplasm of the disc was made and the eye was enucleated. The mass had not

extended backward through the lamina cribrosa but appeared to have invaded the choroid. It proved to be a leucosarcoma. (Bibliography, 5 figures.)

Melchior Lombardo.

Weekers, L. The pathogenesis of nicotine-alcohol optic neuritis. *Revue Bulgare d'Ophth.*, 1943, v. 2, pp. 161-166.

Three factors influence the course of a toxic retrobulbar neuritis. The impairment of the general health, caused by an insufficient diet, the toxic effect of the nicotine, and alcohol which lowers the general and local resistance and sensitizes the nerve elements to the effect of nicotine.

Alice R. Deutsch.

White, J. P., and Lowenstein, A. Unpigmented primary tumor of the optic disc. *Brit. Jour. Ophth.*, 1946, v. 30, May, pp. 253-260.

For two and a half years the authors observed a growing, nonpigmented tumor of the disc in a boy nine years of age. They considered the tumor a blastoma or a phakoma and since these could not be differentiated entirely from glioma, the eye was removed. The tumor consisted of a mass of foamy cells which had infiltrated the surrounding retina and had caused a cavernous degeneration of the optic nerve. Their final diagnosis was phakoma, which is a malformation developing from those undifferentiated neuroectodermal cells that are normally destined to become glial or ganglionic cells. (7 illustrations.)

Morris Kaplan.

Wright, E. J. Nutritional optic neuropathy. *Lancet*, 1946, v. 2, Sept. 14, pp. 401-402.

The syndrome of epithelial and nervous lesions complicated by nutri-

tional optic neuropathy was first recognized by H. Strachan in 1897. Multiple neuritis, trophic scattered skin lesions, and neuritis of the special sense nerves were described. Wright named vitamin A and D deficiency as the cause in 1927. Clark in 1936 concluded that cyanogenic foodstuff, a common factor in the diet of all sufferers of pellagra and allied nutritional diseases, produced a slow prussic acid poisoning. Hobbs and Forbes in 1946 suggested the prophylactic value of first-class protein; which contains much sulphur, as an antidote for cyanogenic food. The author describes his sulphur therapy in this syndrome. Francis M. Crage.

12

VISUAL TRACTS AND CENTERS

André-Van Leeuwen, Maria. **Clinical manifestations of pupillotonia.** *Ophthalmologica*, 1946, v. 111, June, pp. 339-350.

To investigate the hereditary background of four patients with tonic pupils, one with a tonic pupil after internal ophthalmoplegia, and another with a complete Adie's syndrome the author individually examined 63 persons.

There were no other cases of pupillotonia or areflexia in any other member of the families of the afflicted persons but there was a comparatively frequent incidence of hippus, anisocoria, slowing of the accommodation—convergence reflex, and changes in the form of the pupil. Congenital hereditary afflictions of the nervous system were entirely absent. There were many angioneurotic manifestations. Three family members and two afflicted persons who were more than 45 years of age had signs of herpes zoster, a coincidence also noticed by other investigators. (References.)

Alice R. Deutsch.

Franceschetti, A. and Bischler, V. Pharmacodynamic effects on the pupillotonia and accommodotonia in Adie's symptom. *Revue Bulgare d'Ophth.*, 1943, v. 2, pp. 85-89.

Mecholyl in 2.5-percent solution which does not change the size of a normal pupil, causes contraction of the pupillotonic pupil in a remarkable way and diminishes the latent period of accommodation. Prostigmine causes temporary impairment of the pupillary function and of accommodation. Daily doses of quinine improved the accommodation.

Studies of these reactions in two patients are described. The possible connection of the pupillotonia with the myasthenia gravis and myotonic dystrophy are discussed.

Alice R. Deutsch.

García Miranda, A. A reversed Foster-Kennedy syndrome. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Sept., pp. 737-742.

Two cases of frontal lobe tumor with chocked disc on the side of the tumor, and a central scotoma on the opposite side are reported. Ventrilography showed contralateral distension of the ventricles, which explains the compression of the optic nerve. The central scotoma on the side of the tumor is explained by the greater vulnerability of the papillo-macular bundle. (2 illustrations.)

Ray K. Daily.

Garcia Ochoa, R., and Etchemendy, A. N. Atypical Adie's Syndrome. *Anal. Argent. Oft.*, 1945, v. 6, Oct.-Nov.-Dec., pp. 133-143.

A man, 41 years of age, is presented who had a primary syphilitic lesion some years ago, and whose blood serum reactions are negative at present. Vision was normal in each eye as were

the motor status and fundi. A definite anisocoria was present, with the right pupil larger than the left. The pupil did not react to mild light stimuli, but after a latent period reacted slowly and forcefully to light, even after it had been removed. Kneejerks were absent. A complete discussion of the literature is given. The diagnosis must differentiate this lesion from myelitis, meningitis, arteriosclerosis, syringomyelia, and tertiary syphilis. The disease is benign. (Bibliography.) Edward Saskin.

Lodge, W. O. Bitemporal hemianopia. *Brit. Jour. Ophth.*, 1946, v. 30, May, pp. 276-281.

Brief case reports of three patients with pituitary tumors and bitemporal hemianopia are presented. All three were operated upon with immediate good results though two died of recurrence. (2 colored plates.)

Morris Kaplan.

Longhena, L., and D'Ajutolo, F. Opticochiasmatic arachnoiditis. *Riv. Oto-Neuro-Oft.*, 1946, v. 21, Jan.-Feb., pp. 1-42.

The writers report a clinical and surgical study of ten cases of opticochiasmatic arachnoiditis in which surgery was done in the eye department of the University of Bologna. The diagnosis is based almost exclusively on the ocular symptoms: the reduction of vision, the changes in the visual fields, and the changes in the fundus. Under local anesthesia craniotomy by the right transfrontal route was performed and the optic nerves and the chiasm were freed of pathologic adhesions. The ages of the patients ranged from 18 to 54 years. Seven patients were males. The Wassermann reaction was positive in one, symptoms of tuberculosis of the lungs were present in an-

other, nasal and paranasal symptoms were present in two, and chronic alcoholism in one patient. In six patients there was good and permanent improvement, in two the ocular condition remained stationary and two died. The outcome is most favorable in recent inflammations and in those of slow evolution. Neuro-surgical therapy is the treatment of choice. Medical treatment was of no avail. (Bibliography and 20 figures.) Melchior Lombardo.

Love, J. G., and Rucker, C. W. Recovery from blindness following removal of suprasellar epidermoid. *Proc. Staff Mtgs. Mayo Clinic*, 1946, v. 21, May 15, p. 193.

A man, forty-five years of age, presented himself with complete blindness in the left eye. There were only two nasal islands of vision in the visual field of the right eye. Despite the absence of roentgenographic confirmation, a craniotomy was performed and a suprasellar epidermoid cyst was removed. A surprising recovery of vision took place, and after three years, the visual acuity had increased to 6/30 and 6/6, although there was persistent bitemporal hemianopsia. Benjamin Milder.

Mazzini-Rizzo, Ercole. Two cases of opticochiasmatic arachnoiditis treated surgically. *Riv. Oto.-Neuro.-Oft.*, 1942, v. 19, no. 1, pp. 22-48.

One of these extensively studied patients had been suffering from a syphilitic opticochiasmatic arachnoiditis. In the other differential diagnosis was somewhat difficult because of signs of intracranial tumor. In both, surgery confirmed the diagnosis of opticochiasmatic arachnoiditis. In the syphilitic patient one eye became blind in spite of surgery and intensive antiluetic treatment. The other patient retained

some vision in both eyes for four years. Preservation of vision can only be expected if surgery is performed at an early stage. (7 figures.)

K. W. Ascher.

Pendergrass, E. P., and Perryman, C. R. Opticochiasmatic arachnoiditis. *Am. J. Roent.*, 1946, v. 56, Sept., pp. 279-298.

Opticochiasmatic arachnoiditis produces a syndrome similar to that produced by a tumor in the region of the optic chiasm. It may result from syphilitic meningitis, mastoiditis, sinusitis, petrositis, chronic rhinopharyngitis, encephalitis, multiple sclerosis, and tuberculosis. The arachnoid is thickened, grayish, opalescent, and may contain cysts. The optic nerves and chiasm are atrophic and are usually enmeshed in adhesions. Patients complain of loss of vision in one or both eyes and headache that is usually frontal. The optic discs may be normal, but more often are atrophic and ten percent of patients have papilledema. Central scotoma, concentric contraction and temporal loss are the most common field defects. Diagnosis is made by air encephalography. Ten cases are reported. (24 figures.) I. E. Gaynon.

Seidenari, Renato. Craniopharyngioma in an adult patient with a choked disc. *Riv. Oto.-Neuro.-Oft.*, 1941, v. 18, no. 4, pp. 293-299.

A 26-year-old female patient developed a central scotoma for white and for colors in the right eye and a relative central scotoma and a complete temporal paracentral hemianopic scotoma in the left. Ophthalmoscopy revealed a choked disc in the right eye and a postneuritic optic nerve atrophy in the left. A suprasellar tumor was diagnosed after ventriculography, and

surgery resulted in removal of a suprasellar prechiasmic craniopharyngioma.

E. W. Ascher.

Whitten, R. H. Scotoma as a complication of decompression sickness. *Arch. of Ophth.*, 1946, v. 36, Aug., pp. 220-224.

Forty-one medical students were exposed a total of 100 times to lowered barometric pressure in a decompression chamber that was equivalent to ascents to simulated altitudes of 35,000 and 38,000 feet (10,600 to 11,500 meters). Pure oxygen was supplied for altitudes above 10,000 feet (3,000 meters). Twenty-eight men on 37 ascents suffered from decompression sickness. Ten men on 18 of 34 ascents manifested various visual symptoms or headaches. Five men on 7 of 11 ascents manifested scotomas. The scotomas were of a bilateral homonymous, incongruous type with macular sparing, peripheral drifting, and continuity across the vertical midline. Identification of the causative lesion is not at present possible.

John C. Long.

13

EYEBALL AND ORBIT

Brognoli, Carlo. Intermittent exophthalmos, probably from a sympathetic lesion simulating the picture of angioneurotic edema of Quincke. *Arch. di Ottal.*, 1946, v. 50, March-April, pp. 74-96.

Brognoli describes and discusses in great detail the experience of a woman, 20 years of age, who had recurrent edema of the lids and exophthalmos for several months. The lids of the right eye had a non-inflammatory, non-pitting edema and the eye was displaced moderately forward and slightly laterally. Ocular motility was normal.

There was no pulsation or bruit. In the fundus there was edema of the disc and retina, dilatation and tortuosity of the vessels, and no hemorrhage. The left eye was externally normal and there was slight edema of the nasal border of the optic disc. Vision was 0.2 and 0.7 in the right and left eye respectively.

About the twenty-fourth day after admission the patient developed severe headache and later became irrational and convulsive. Because of obstructed breathing a rhinologic examination was done and hypertrophy of the right middle turbinate was noted. The turbinate was removed. Within three days the edema and the exophthalmos had disappeared. The fundus and the vision slowly returned to normal. The symptoms had not recurred after four months.

Brognoli believes that the middle turbinate stimulated branches of the sphenopalatine ganglion.

Francis P. Guida.

Brown, A., and Harper, R. K. Craniofacial dystosis; the significance of ocular hypertelorism. *Quart. J. Med.*, 1946, v. 15, July, pp. 171-182.

The author differentiates the chief types of craniofacial dystosis. Among them hypertelorism is a deformity associated with undue separation of the orbits. It is present in infancy, persists throughout life, and is usually bilateral. Mental defects may be present. Patients usually have strabismus and defective visual fields. Binocular vision is considerably impaired for near. The history and literature is reviewed and the author presents two families in which the condition was present in three generations. Orwyn H. Ellis.

Capus, B. *Clostridium welchii* pan-

ophthalmitis. Arch. of Ophth., 1946, v. 36, Aug., pp. 226-228.

A soldier was injured by the explosion of a wooden land mine that produced lacerations of the face and a puncture wound of the left eye. He was promptly given penicillin and sulfadiazine. In spite of this medication the eye became immobile, proptosed and extremely tender. There was no light perception. Pressure on the cornea resulted in a gush of coffee-colored exudate and gas with a characteristic odor. Evisceration was performed, and within the liquefied necrotic contents was found an irregular piece of wood. The same coffee-colored exudate was found in the facial wounds. Smears and cultures from the eye revealed a gram-positive bacillus with all the cultural and morphologic characteristics of *Clostridium welchii*. All signs of systemic effects of the toxin ceased after the patient was given 180,000 units of tetanus-gas gangrene antitoxin intravenously.

John C. Long.

Cristini, Giuseppe. Ocular changes in experimental hypoglycemia.. Riv. di Oftalm., 1946, v. 1, March, pp. 156-179.

Five female guinea pigs, weighing between 600 and 800 grams each, were used for insulin experiments. They received doses ranging between 40 and 200 units and a total of 400 to 2,000 units of insuline. The blood sugar values after observation of two to fifteen convulsions, were 0.70 to 0.35. The method used for blood sugar determination was that of Crecelius and Seifert. During the hypoglycemic attacks the pupils were markedly dilated and failed to react to strong light. Intraocular pressure decreased during these attacks and became very low before the animals died. The corneal microscope revealed no changes of the

corneas nor of the anterior chambers although a slight hyperemia of the iris vessels was obvious. About two hours after the administration of the drug, a slight opacification of the anterior suture lines of the lens was noticed. High-power biomicroscopy showed finest striation originating at right angles from the suture lines. At this stage the lenses appeared opalescent; with progressing intoxication, they assumed a milky appearance which showed some regression when, after glucose administration, the animals were brought back to normal blood sugar levels. Small cortical opacities that developed later on between the anterior discontinuity zones, proved to be irreversible after glucose administration. In one of the animals, a transient change of the anterior lens grain was observed. If the animals succumbed, they were used for histologic examinations. Vascular as well as parenchymatous changes were observed in the organs and severe retinal, choroidal, and optic nerve affections were encountered. The possible mechanism of the pathogenesis of these alterations and those of the lens is discussed. The lenticular changes seem to result from anoxia. (Bibliography.)

K. W. Ascher.

De Leonibus, F. Histologic study of the ocular and orbital metastases of the transplantable malignant lymphosarcoma of fowls. Ann. di Ottal. 1946, v. 73, April, pp. 207-216.

This tumor, discovered by Pentimalli and described by him in 1940, has many resemblances to lymphatic leukemia and sarcomas. When inoculated in the pectoral muscles of fowls there is metastatic dissemination and proliferation of the cells in the orbital and ocular tissues. The lacrimal gland was a favored site for massive infiltration. Transplants

thrive in the anterior chamber and spread through the sclerocorneal trabecula along the arteries and veins to the subconjunctival tissue and invade the vascular tunic of the globe.

Harry K. Messenger.

García Miranda, A. Fibroma of the orbit. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Sept., pp. 759-767.

The literature is reviewed and a fibroma in the left orbit of a 25-year-old man is reported. The tumor was extirpated and recovery was uneventful. (4 photographs, 2 microphotographs.)

Ray K. Daily.

Goldmann, H. Reconstruction of a socket for prosthesis. (*Höhlenplastik*.) *Ophthalmologica*, 1944, v. 107, Jan. Feb., p. 60.

After removal of all conjunctival remnants and dissection of the skin and external canthus to the bony margin of the orbit an impression of the socket is made with pliable "Kerr Masse." A Thiersch flap from the thigh is wrapped around this moulage and put in place. Adaptation of the lids follows. The external canthus is reconstructed in a second operation, one week later, followed by the reconstruction of the fold of the upper lid (ptosis operation after Elschmig).

Max Hirschfelder.

Jona, Sergio. Direct and indirect orbital fractures radiating into the optic canal. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, no. 1, pp. 49-69.

Among seven meticulously observed patients suffering from either direct or indirect fractures of the bony orbit, none showed any fifth nerve lesion, amazingly few extraocular muscle involvement, and only one had enophthalmos. In five patients, a descending

optic nerve atrophy occurred, causing total irreparable blindness; two remaining patients developed hemianopia. The author considers severe contusion of the nerves to be responsible for the pathogenesis of the nerve lesions. In patients with initially well preserved visual function, later formation of a bony callus may cause a final loss of vision. (Six X-ray photographs, bibliography.)

K. W. Ascher.

Kalfa, S. F. A case of pulsating traumatic enophthalmos. *Oftal. Jour.* (Odessa), 1946, pt. 2, pp. 15-18.

Kalfa reports a case of fracture of the orbit with separation of the fragments in the superior external portion of the orbit that resulted in pulsating enophthalmos and ptosis. There was no aneurismal bruit or dilatation of the ocular veins. The pulsation of the eyeball was very pronounced and was synchronous with the pulse. The enophthalmos is attributed to the separation of the fragments in the superior orbital wall and a recession of the orbital fat towards the cranium. The pulsation is believed to result from transmission of the pulsation of the brain through the defect in the orbit. Tenotomy of the four rectus muscles was without effect on the enophthalmos.

Ray K. Daily.

Marin Amat, M. and Marin Enciso, M. Colobomatous cyst and microphthalmos. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, July, pp. 566-578.

One more case of colobomatous cyst and microphthalmos is added to the literature of ophthalmologic teratology. It occurred in an infant, twelve days of age, whose left eye was normal. A detailed anatomic study of the malformation is reported. (7 illustrations.)

J. W. McKinney.

Massoud, F. Proptosis-differential diagnosis. *Brit. Jour. Ophth.*, 1946, v. 30, Oct., pp. 622-630.

For purposes of differential diagnosis, cases of proptosis are divided into six categories. 1. Apparent—as in myopia and buphthalmos. 2. Congenital anomaly—as in shallow orbit and cranial hernia. 3. Trauma—as in cavernous sinus thrombosis and arteriovenous aneurism. 4. Inflammatory process. 5. New growths. 6. Systemic conditions—as in hyperthyroidism and hyperplastic blood dyscrasias. The author presents eight case reports very briefly.

Morris Kaplan.

Ortin, L. G. Orbital hemorrhages in early infancy. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, March, pp. 227-237.

Two cases of large subperiosteal hemorrhage in the outer portion of the orbit, in infants under two years of age are reported. There was a vague history of trauma in each and both recovered completely under large doses of vitamin C. A vitamin C deficiency is the probable etiology.

Ray K. Daily.

Sédan, Guiral, and Reinhard. Sebaceous orbital cyst associated with a large lacuna of the craniofacial skeleton that suggested a meningocele or even an encephalomeningocele. *Ophthalmologica*, 1946, v. 112, Aug., pp. 57-62.

In 1934, Sédan observed a small nasoörbital meningocele with a very large gap in the skull. The X-ray picture appeared in the radiological Atlas of Hartmann. The author, in collaboration with Guiral and Reinhard saw a second, radiologically identical case with a genuine nasoörbital hole, in a

little girl with a congenital orbital sebaceous cyst, not of a dermoidal character. Its removal was successful.

Despite the different nature of the conditions two X-ray pictures were identical. (2 X-ray plates.)

F. Nelson.

Tolosa, E., and Gospert de Ignacio. Fronto-orbital multiocular cyst, lined with respiratory mucous membrane. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Oct., pp. 840-855.

A case of mucocele of the right frontoethmoidal sinus extending into the cranium in a woman, 45 years of age, is reported. The ocular symptoms were unilateral exophthalmos, displacement of the eyeball down and out, and involvement of the first, second, and third cranial nerves on the diseased side. The patient also had symptoms of increased intracranial pressure, and epileptiform attacks. The radiographic studies were suggestive of a dermoid. The neoplasm was extirpated through craniotomy and was found to consist of a multilocular mucocele, lined with respiratory mucous membrane and filled with a sterile mucopurulent material. The literature on mucoceles extending into the cranium is reviewed.

Ray K. Daily.

Tristaino, L., and Jannetti, D. Orbital empyema following dacryoethmoiditis and pansinusitis. *Riv. Oto-Neuro-Oft.*, 1941, v. 18, Nov.-Dec., pp. 475-489.

Orbital abscess followed dacryocystectomy in a patient suffering from pansinusitis. The authors stress the possible spread of inflammatory processes from the lacrimal sac to the ethmoid, and vice-versa; abnormally extensive pneumatization may favor the

propagation of the disease to all of the nasal sinuses. K. W. Ascher.

Welti, H., and Offret, S. Malignant exophthalmos. Its surgical treatment. *Rev. Oto-Neuro-Oft.*, 1946, v. 21, Jan.-Feb., pp. 7-15.

This type of exophthalmos, not due to retrobulbar neoplasm, is so serious as to warrant surgical intervention in order to prevent grave trophic corneal alterations or damage to the visual pathway. The surgical technique described has as its goal the reduction of retrobulbar edema and the establishment of physiologic drainage. It is essentially a subcutaneous decompressing trepanning of the anterior portion of the temporal fossa. Results have been anatomically satisfactory with improvement in visual acuity. (10 illustrations.) Edward Saskin.

Wolpaw, B. J. Orbital hemorrhages following pressure on neck. *U. S. Naval Med. Bull.*, 1945, v. 46, Sept., pp. 1469-1471.

A sailor was rendered unconscious for 30 seconds by application of neck pressure, in a "strangle-hold." Hemorrhages of lids, conjunctivae and orbit were noted immediately thereafter. The remainder of the eye examination and capillary fragility tests were normal. There were no signs of cerebral injury. Benjamin Milder.

14

EYELIDS AND LACRIMAL APPARATUS

Arruga, H. The form of lacrimal probes. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Nov., pp. 943-948.

After a criticism of the lacrimal probes in use, Arruga describes his probes, which are bayonet-shaped, and similar to the Ziegler probes, except

that their lower end is 22 mm. instead of 35 mm. long. These do not impinge on the superciliary ridge, and do not press on the bone. (8 illustrations.)

Ray K. Daily.

Bangerter, A. Contribution to the diagnosis and therapy of lacrimation. *Ophthalmologica*, 1944, v. 107, Jan.-Feb., pp. 51-54.

Systematic examination of the lacrimal canaliculus and the tear sack is indicated whenever the fluorescein test is negative. Positive irrigation of the sack after minimal introduction of the canula (just passing the tearpoint) indicates an abnormal position of the punctum or its stenosis. If it is impossible to irrigate the sack after this short introduction, an obstruction of either the canaliculus itself or of the tear-sack must be assumed. The differential diagnosis concerns the location or the type of such an obstruction and is made by passing the canula forward with a further trial of irrigation. Probing, and injections of privine, which produces shrinkage of the mucous membrane, complete the investigations. Valve formation within the canaliculus is treated with electrocoagulation and a residual probe for a few days. A stenosis of the canaliculus or the duct is sometimes cured by repeated probing with introduction of a temporary rubber band. The author recommends dacryocystorhinostomy for patients who cannot be benefited by these conservative methods. Max Hirschfelder.

Barraquer, T. Internal fistula of the lacrimal sac. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Oct., pp. 896-897.

A three-year-old child with a phlegmon of the lacrimal sac and intense pericystitis was treated by an

incision into the lacrimal sac, evacuation of pus, and packing. In packing it was noticed that the cavity was very deep. By irrigation with mercurochrome it was demonstrated that the sac opened into the nose. When healed there was a larger lacrimonasal communication than normal.

Ray K. Daily.

Barraquer, T. The preliminary staining of the lacrimal sac in operations on the sac. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Oct., pp. 884-886.

Barraquer injects a five-percent fresh aqueous solution of methylene blue into the lacrimal sac just before extirpating it. A few moments before beginning the operation, pressure over the sac expells the dye, leaving its wall stained. Failure to do so leads to staining of the entire operative field as soon as the sac is opened. With the excess solution expelled the walls of the sac stand out in dark contrast, and total extirpation is facilitated.

Ray K. Daily.

Gonzales, J. B. Dacryostomy in industrial accidents. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Oct., pp. 887-895.

The author presents tabulated data on the results in 28 cases of extirpation of the lacrimal sac, and 48 cases of dacryocystorhinostomy, performed as a part of the therapy of traumatic corneal ulcers. The data clearly show the superiority of dacryocystorhinostomy. The final visual acuity is better and the course of the corneal infection is shortened.

Ray K. Daily.

Guelbenzu, M. D. A contribution to dacryocystorhinostomy. A continuous suture of the anterior mucous membrane flap. *Arch. de la Soc. oft. Hisp.-Amer.*, 1945, v. 5, Nov., pp. 949-964.

Anesthesia, skin incision, trepanation, and formation of the mucous membrane flaps do not differ from the customary type. For enlarging the lacrimo-nasal opening the author devised a trephine which works rapidly without danger of injuring the nasal mucosa. The posterior flap is sutured in the customary manner; the anterior flap is sutured with a continuous silk suture, which can be removed without traumatizing or disturbing the flaps. The ends of the suture come out thru the skin, on the nasal side of the incision, and a central loop is held against the nose with adhesive plaster in such a way that the anterior mucosal flap is pulled forward. (7 illustrations.)

Ray K. Daily.

Guyton, Jack S. A simple method of removing eyelashes by electrolysis. *Amer. Jour. Ophth.*, 1947, v. 30, Jan., pp. 57-58.

Knapp, P. Treatment of blepharoclonus with injection of alcohol. *Ophthalmologica*, 1944, v. 107, Jan.-Feb., pp. 63-66.

Severe blepharoclonus can be remedied with injections of 1 to 2 c.c. of 70-percent alcohol. The injection is preceded by local anaesthesia and 2-percent novocaine solution 15 minutes before the alcohol injection into the orbicularis muscle. Hot compresses are recommended. Usually, five to eight injections were necessary and recurrences were frequent. However, they could be suppressed by more alcohol injections. Of 26 patients 24 responded to this treatment. Most of the patients were over 60 years of age.

Max Hirschfelder.

Marin Amat, M. and Marin Enciso, M. Treatment of ectasia of the lacrimal

sac by partial resection of its anterior wall. Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, Aug., pp. 822-827.

The authors advocate resection of the anterior lacrimal wall with forcible dilatation of the nasolacrimal opening as a simpler procedure and just as effective as extirpation of the lacrimal sac or dacryocystorhinostomy. The sac is exposed as for dacryocystorhinostomy. After excision of the anterior wall of the dilated sac a number 5 or 6 probe is passed into the nose through the lacrimo-nasal opening. The walls of the sac are sutured with a continuous heavy silk suture, the ends of which are passed through the skin, and tied over beads. Suture of the skin incision and irrigation of the lacrimal sac to insure its permeability completes the operation. Acute infection and impermeability of the lacrimo-nasal opening are contraindications. As the last point is not predictable, the authors suggest that every surgical approach in chronic ectasia be begun as this procedure. It can be converted to an extirpation of the sac or a dacryocystorhinostomy, as the indications for these procedures become apparent during the operation.

Ray K. Daily.

Marin Enciso, M. Bilateral hysterical pseudoptosis. Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, April, pp. 357-360.

Hysterical pseudoptosis is in reality not a ptosis, but a spasmodic blepharospasm. It is usually monocular; bilateral involvement is very rare. A woman, 39 years of age, with an irrelevant history, and without neuropathic antecedents in the family, developed a bilateral inability to open the eyes. There were no folds in the lids or forehead, position of the eyebrows was normal and there was resistance

to having the lids lifted by the examiner. The patient was cured by injection of novocain and alcohol into the outer canthi with the assurance of a cure. The author stresses the importance of coupling suggestion with objective therapeutic measures, to which the patient and the family may attribute the cure. A very dogmatic behavior on the part of the physician may lead to failure.

Ray K. Daily.

Moreu, A., and Fornes, E. A case of epithelioma of the lachrymal gland. Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, Jan., pp. 59-63.

A tumor of the lachrymal gland was excised and two months later it recurred at the orbital margin. Excision of the recurrent nodule was supplemented by irradiation, with no further recurrence. Histologic examination revealed an epithelioma of low malignancy. (2 microphotographs.)

Ray K. Daily.

Rintelen, F. The therapy of lachrymation. Ophthalmologica, 1944, v. 107, Jan. Feb., pp. 32-42.

This paper classifies the causes of lachrymation. They may be hypersecretion of the tear gland, anomalies of the position of the lids and stenosis of the lachrymal duct. The physiology of the lachrymal apparatus and the various means for correction of pathologic changes are discussed.

Max Hirschfelder.

Spaeth, E. B. Blepharoptosis. Trans. Amer. Acad. Ophth. and Otolaryng., 1946, March-April, pp. 142-162.

Approximately 100 patients with blepharoptosis who were examined and treated by the author during a 20 year period are classified and analyzed surgically.

Congenital ptosis is classified as follows: 1. Unilateral ptosis without superior rectus involvement (40 percent); 2. unilateral ptosis with involvement of homolateral superior rectus (21 percent); 3. bilateral ptosis without superior rectus involvement (7 percent); 4. bilateral ptosis with bilateral superior rectus involvement (8 percent); 5. unilateral ptosis with weakness of both superior recti, but more marked in homolateral eye (2 percent); 6. ptosis with more or less complete third nerve and even with sixth nerve paralysis (9 percent); 7. ptosis with classical jaw-winking reflex (3 percent); 8. ptosis with Duane retraction syndrome (2 percent); 9. ptosis with neurofibromatosis (10 percent).

Acquired or symptomatic ptosis is etiologically and anatomically classified as follows: 1. traumatic peripheral; as in sectioning of the levator, in cicatrization, in osteomyelitis, after blepharoplasty, and after reconstruction of a socket; 2. traumatic, central and cerebrospinal; in 3rd nerve paresis or paralysis, and cervical sympathetic paralysis due to nerve section; 3. neoplastic or inflammatory peripheral; 4. atonic; senility and blepharochalasis, and after simple enucleations; 5. neuromuscular disturbances; myasthenia gravis, myasthenia of thymic tumors, ophthalmoplegias of thyrotoxicosis; 6. ptosis of cervical sympathetic involvement; Horner's syndrome; 7. ptosis of third nerve lesions; 8. ptosis with pseudo-Graefe syndrome; 9. hysterical ptosis.

Congenital ptosis in classes 1, 2, 4, and 5, and occasionally 9 is usually best corrected by a levator advancement with a partial tarsectomy. Those of class 3 are ideal for the Mouton-Parinaud technique. Ptosis in class 6 and those in 1, 2, and 4, which are accom-

panied by completely paralyzed levators is best corrected by the techniques of Gifford, Hunt-Tansley, or Reese in which fibers of the orbicularis are transplanted. In patients in class 6 extraocular muscle surgery should be done before correcting the ptosis. Those in classes 7 and 8 are corrected by tenotomy with tenectomy of the levator (resection without reattachment) and later a Reese transplant of the orbicularis fibers to the occipitofrontalis. Those in class 9 are corrected by the Hess technique.

In acquired ptosis in class 1 the levator is used if not severed. When the levator is severed, the occipitofrontalis is used. In patients in class 3 the underlying orbital condition should be corrected before correcting the ptosis. For ptosis in class 4 a levator resection with resection of the atonic skin is indicated, and the skin should be quilted to the anterior surface of the tarsal plate. Ptosis in myasthenia gravis is not a surgical problem; removal of a thymic tumor corrects the ptosis in thymic myasthenia; thyrotoxic ptosis usually requires an orbicularis transplant. In ptosis of class 6 a levator advancement by the transconjunctival route is indicated. In classes 2 and 7 surgery for oculomotor paralysis should precede the use of orbicularis or fascia lata transplants to utilize the occipitofrontalis. In class 8 a levator myectomy and tenotomy is indicated; surgery for the accompanying ocular paralyses may then be done. For ptosis of class 9 no surgery is indicated.

The occipitofrontalis, the superior rectus if normal, and the levator may be used surgically. Levator advancements demand a partially intact levator, and may be done after the second year of life. Superior rectus utilization on the Parinaud-Mouton principle, is never

done unilaterally; the Kirby and Shoemaker modifications are best. Bilateral levator or superior rectus surgery should be done on both eyes at the same time and not before the third year of life. Ptosis in infants, especially when bilateral, should be operated upon early; crutch glasses may be used beforehand. Crutch glasses are of especial service in complete external ophthalmoplegias.

A chart of the several types of ptosis and their surgical indications is presented. Charles A. Bahn, M.D.

Verzella, Mario. Malignant neoplasms of the Meibomian glands. *Riv. di Oftalm.*, 1946, v. 1, March, pp. 189-212. (See Section 15, Tumors.)

15

TUMORS

Ajo, Aarni. A case of chondroma bulbi. *Brit. Jour. Ophth.*, 1946, v. 30, Aug., pp. 465-470.

A 19-year-old Finnish sailor complained of pain, redness and dimming of vision for two years in an eye in which the vision had been poor since early childhood. As long as the patient could remember he had had two tumors in the conjunctiva. Examination revealed a nearly blind eye with two discrete cylindrical tumors under the conjunctiva that extended up into the upper fornix and into the stroma of the opaque cornea. Biopsy revealed a true hyaline cartilage tumor intimately mixed with lacrimal gland tissue. Enucleation was refused but the patient returned in a year when the tumors had grown appreciably. This growth seemed malignant but surgery was again refused. (6 illustrations.)

Morris Kaplan.

Bertoldi, Maria. Adenoma of the Meibomian glands. *Rassegna Ital. d'Ottal.*, 1941, v. 10, March-April, p. 211.

A tumor was seen in the left lower lid of a 43-year-old woman two years before its complete removal. It had originally been treated as a chalazion and partially removed three times before. The histologic preparation showed a characteristic picture of an adenoma of the Meibomian glands. This benign tumor is less frequently seen than the epithelioma. (3 figures.) E. M. Blake.

Bonnet, P. A diffuse hyperplastic papillomatous tumor of the cornea, originating from an old pannus. *Revue Bulgare d'Opht.*, 1943, v. 2, pp. 44-54. (See Section 6, Cornea and sclera.)

Di Ferdinando, R. An angiomixosarcoma of the choroid arising in the stump of an exenterated globe. *Rassegna Ital. d'Ottal.*, 1941, v. 10, March-April, p. 182.

A 52-year-old woman first observed loss of sight in the right eye at the age of 16 years. Eight years later the eye was blind and troublesome and enucleation was advised and refused. After the lapse of another five years an exenteration of the globe was performed and a good motile stump resulted. No further symptoms were observed for eight years when the shrunken eye gave pain and a fungating mass gradually developed. This was removed and the histologic examination revealed an angiomixosarcoma. (9 figures.)

E. M. Blake.

Moreu, A., and Fornes, E. A case of epithelioma of the lacrimal gland. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Jan., pp. 59-63.

(See Section 14, Eyelids and lacrymal apparatus.)

Sykes, E. M. Interstitial irradiation therapy in carcinoma, originating at the limbus. *Texas St. J. Med.*, 1946, v. 42, Oct., pp. 376-380.

Radon seeds were implanted between the sclera and conjunctiva and sutured into position there in patients with primary squamous celled epithelioma at the limbus. In one there has been no recurrence after five years and after one year in the other.

The radium element seed or tube is described and notes are given on how to use it on the eyeball.

Francis M. Crage.

Verzella, Mario. Malignant Neoplasms of the Meibomian Glands. *Riv. di Oftalm.*, 1946, v. 1, March, pp. 189-212.

According to Morax, only 34 cases of carcinoma of the Meibomian glands have been described since Graefe reported the first one in 1864. Bertoldi collected 43 by 1941, and the author adds four of his own. Photomicrographs and colored pictures accompany the extensive case reports; a painstaking discussion of the characteristics of these rare tumors follows. The patients are usually more than 40 years of age and of either sex. The majority of these tumors involve the upper lid. Chalazea or simple adenomas may be the forerunners of the Meibomian carcinoma. Metastasis in lymphatic nodes has rarely been found, and generalized metastasis occurred in only eight of the published cases. Differential diagnosis in biopsies is difficult because of the lack of definite signs of malignancy in tumors of rapid growth and invasive type. In the carcinomas of the Meibomian glands, the characteristic seems to be a rapid "sebaceous maturity" which also is encountered in the metastatic tumors.

Surgery with subsequent irradiation is recommended. K. W. Ascher.

White, J. P., and Lowenstein, A. Unpigmented primary tumor of the optic disc. *Brit. Jour. Ophth.*, 1946, v. 30, May, pp. 253-260. (See Section 11; optic nerve and toxic amblyopias.)

16

INJURIES

Alagna, G. Hydrocyanic acid intoxication and the eye. *Ann. di Ottal.*, 1946, v. 73, April, pp. 217-233.

An eight-year-old boy died of hydrocyanic acid poisoning about twelve hours after eating some thirty apricot seeds. Ophthalmoscopic examination a few minutes before death showed diffuse edema of the retina of each eye, with a cherry-red spot at the macula; the optic disc was hazy and its margin was blurred. The ophthalmoscopic picture was on the whole very much like that of recent closure of the central retinal artery. Histologic examination showed atrophic and degenerative changes in the retina and optic nerve. The ganglion cells and nerve fibers were particularly affected. There was no involvement of the anterior segment of the eyes or of the adnexa.

The lesions in the retina and optic nerve are attributed to the direct action of the acid upon the nerve cells and their fibers. The acid acts by paralyzing the mechanisms of oxidation, with resulting asphyxia of the vulnerable third neuron.

Harry K. Messenger.

Belmonte Gonzalez, N. and Vidal Frias, J. Localization of intraocular foreign bodies by means of the radiographic visualization of the globe with contrast substances. *Arch. de la Soc.*

Oft. Hisp.-Amer., 1945, v. 5, July, pp. 558-565.

The author demonstrates the importance of the use of contrast substances to facilitate the localization of intraocular foreign bodies. This is done by using Per-Abrodil, which is injected into Tenon's capsule. It is easily done, is not expensive and not dangerous.
J. W. McKinney.

Cruthirds, A. E. Importance of sulfhydryl in the treatment of corneal and X-ray burns. *Am. J. Surg.*, 1946, v. 72, Oct., pp. 500-509.

In X-ray burns one is not to be concerned only with the burn but with an injury which leaves the underlying tissue devitalized. The skin contains 60-percent of the sulfur in the body. A serious or extensive burn disturbs the sulfur metabolism.

In the eye, as elsewhere in the body, all the minerals are present but potassium and sulfur predominate. Glutathione, containing -SH groups (sulfhydryl), is present in large quantity in the normal lens and is said to be essential for tissue oxidation. The cataractous lens has been found devoid of glutathione.

Over 500 cases of burns involving the eyes and adjacent areas were treated with a high concentration of sulfhydryl, a colloidal sulfur compound that stimulates epithelium. Its proprietary name is hydrosulphosol.

In an eye with extensive multiple pneumococcal corneal ulcers with hypopyon so severe that enucleation was considered, recovery promptly followed subconjunctival and parenteral application of penicillin and hydrosulphosol eye drops and packs. The author has not observed such excellent results with penicillin alone.

The drug is neither toxic nor incom-

patible with other drugs. When sprayed on the skin it quickly forms a dry flexible membrane which requires no other covering. The results in infected, indolent X-ray burns have been most gratifying. Francis M. Crage.

Dejean, C., and Sedan, J. A clinical and experimental study of corneal lesions caused by indelible pencil and their treatment. *Revue Bulgare d'Opht.*, 1943, v. 2, pp. 75-83. See Section 6, cornea and sclera.)

Esteban, Mario. The estimation of ocular disability in industrial injuries. *Arch. de la Soc. oft. Hisp.-Amer.*, 1945, v. 5, Nov., pp. 965-980.

The author discusses various methods for the estimation of visual disability after industrial accidents. He makes a plea for a standardized method, such as is used in the United States, and for a routine preemployment ocular examination of workers. The tables for the evaluation of ocular war injuries as adopted in May 1938 is given in entirety. Ray K. Daily.

Farnarier, G. Extraction of foreign bodies without provoking cataract. *Ann. d'Ocul.*, 1946, v. 179, March, pp. 163-165.

Magnet extraction of foreign bodies from the anterior part of the lens with immediate contraction of the pupil as advised by Elschnig was successfully used by the author. The miosis produces an adhesion between the iris and the anterior lens capsule which theoretically prevents aqueous from coming in contact with lens substance. The pupil at the time of operation is best dilated with a subconjunctival injection which does not interfere with eserine myosis. Obviously, the foreign substance must be small and magnetic,

located near the anterior lens capsule and be neither central nor too peripheral. Its extraction must be performed almost immediately after injury.

Chas. A. Bahn.

Guy, L. P. Use of Berman locator in removal of magnetic intraocular foreign bodies. *Arch. of Ophth.*, 1946, v. 36, Nov., pp. 540-550.

Experience with the Berman Locator has demonstrated that the best foreign body work cannot be done without it. It is a portable electromagnetic device that is self-sufficient in many cases for all preoperative and operative localization of magnetic foreign bodies.

In the operating room, the Locator provides localization of pinpoint accuracy with which to check and, if necessary, to correct the roentgenologic localization previously obtained and provides information as to how much magnetic force is necessary. Its detecting element is sufficiently small for use in intraocular foreign body work and can be sterilized.

The combined use of the Locator with roentgenograms meets most of the ideal requirements for localization of foreign bodies. The roentgenogram discloses the presence of the foreign body, its dimensions and its position. The Locator tells whether it is magnetic and approximately to what degree.

As a probe approaches the site of the foreign body, the meter needle rises on the scale, and simultaneously the sound from the speaker rises in pitch. The position on the surface where the peak indication is obtained marks the precise spot for incision. The principles, care, and manner of use of the instrument are described.

R. W. Danielson.

Hughes, W. F., Jr. The treatment of Lewisite burns of the eye with BAL. *J. Clin. Invest.*, 1946, v. 25, July, pp. 541-548.

When relatively small quantities of Lewisite liquid or vapor come in contact with an eye a devastating ocular lesion results. There is rapid tissue necrosis, marked conjunctival and corneal edema, and intense exudation. On contact with the moist surface of the eye, Lewisite immediately hydrolyzes with the production of an arsine-oxide and hydrochloric acid. The superficial corneal opacity produced by this acidity prevents BAL from having any beneficial effect on the eye.

Within ten minutes after exposure to Lewisite there is histological evidence of damage in all tissues of the anterior ocular segment, indicating deep penetration and rapid necrotizing action.

Over 600 rabbit eyes were exposed to Lewisite. No residual toxic material or arsenic remained on the corneal surface within two to four minutes after the instillation of the liquid Lewisite into the eye followed by the closure of the lids. A single instillation of BAL solution or ointment within two to five minutes after exposure to Lewisite, effectively prevented the development of serious ocular lesions. The excellent therapeutic effect of BAL is due, in part at least, to its rapid penetration and neutralization of toxic arsenical material in the tissues before irreversible histologic changes have developed. If treatment is delayed five minutes, the Lewisite reaction lasts a few days. If delayed 10 minutes corneal opacities are still present at the end of a week. When used within 30 minutes BAL lessens the severity of the process, but permanent damage to the eye remains.

F. M. Crage.

Hughes, W. F., Jr. Alkali burns of the eye. *Arch. of Ophth.*, 1946, v. 36, Aug., pp. 189-214.

This is a detailed clinical and pathologic study of the course of alkali burns, based largely on sodium hydroxide burns of the rabbit eye. During the acute stage there is ischemic necrosis and edema of the conjunctiva and limbal region of the sclera, sloughing of the corneal epithelium, histologic evidence of rapid and deep penetration of the alkali with necrosis of cells in the corneal stroma and endothelium, loss of corneal mucoid, edema of the corneal stroma and ciliary processes, and infiltration of polymorphonuclear cells into the cornea and iris.

During the reparative stage there is subsidence of conjunctival and corneal edema, regeneration of the conjunctival and corneal epithelium, vascularization of the cornea, clearing of the corneal opacification, proliferation of elongated mononuclear cells at the periphery of the burned area in the corneal stroma, regeneration of the corneal endothelium, and disappearance of the iritis.

During the stage of late complications there may be localized corneal infiltrations, progressive or recurrent corneal ulceration, overgrowth of the cornea with a vascularized membrane, permanent corneal opacification, staphyloma of the cornea, persistent or exudative iritis, glaucoma, cataract, and symblepharon.

Unlike the nonprogressive course of acid burns, alkali penetrates rapidly and deeply into the anterior ocular segment, and mucoid disappears from the involved corneal stroma. (41 photographs.)

John C. Long.

radiant energy. *Trans. Amer. Acad. Ophth.*, 1946, July-Aug., pp. 230-240.

All radiations longer than 30,000 A.U. are absorbed in the cornea. A progressive increase in transmission occurs to 11,000 A.U., where 90 percent of luminous energy is transmitted through the cornea. Infrared rays of 10,000 A.U. are transmitted by the lens and absorbed by the iris. The retina receives practically none. Absorbed infrared rays raise the tissue temperature and if strong enough cause immediate thermal damage. Prolonged and severe exposure causes lens opacities that begin in the axial and posterior part. Splitting of the anterior capsule with free margins floating in the anterior chamber is the first stage of glass blowers' cataract caused by prolonged exposure to radiation of wave lengths from 10,000 to 18,000 A.U. Visible rays from 3,900 to 7,800 A.U. are transmitted through the ocular media to the rods and cones where the surplus is transformed into heat and may cause a thermal burn. The lens absorbs ultraviolet rays from 3,200 to 3,800 A.U., the cornea absorbs those below 3,200 A.U. Ultraviolet rays penetrate the tissues and may produce abiotic effects. After a latent period of six to eight hours after exposure, pain, lacrimation and corneal dullness frequently occur. Several months may elapse before gamma radiations of X ray and radium have their full effect. A disc-shaped opacity at the posterior pole of the lens surrounded by a ring of minute discrete opacities may be produced. Opacities in the capsule or beneath it may be caused by lightning and electric currents. For protection against excessive infrared rays, lenses that contain ferric oxide are of service; for excessive ultraviolet light exposure, cobalt lenses are preferable.

Kutscher, C. F. Ocular effects of

Leaded equipment is necessary to protect the tissues from gamma rays.

Chas. A. Bahn.

Law, Frank. W. Minor injuries of the eyes. *Jour. of Social Ophth.*, 1946, v. 3, July, pp. 3-14.

The author describes the treatment of "black eye," commotio retinae, abrasion and laceration of the conjunctiva, foreign bodies, burns, and radiation injuries. Fluorescein should always be instilled to determine the extent of surface injury. The shape of the pupil and depth of the anterior chamber are the most reliable external signs of intraocular damage. Blood in the eye or a black pupillary reflex indicates a major injury. Whenever intraocular foreign bodies are suspected an X-ray examination should be made.

I. E. Gaynon.

Mathis, G. Ocular lesions due to vapors of fluorine and its derivatives. *Rassegna Ital. d'Ottal.*, 1941, v. 10, May-June, p. 327.

The observations of 57 cases of palpebral and conjunctival irritation, caused by direct contact or exposure to fumes of fluorine, among 252 workers, are reported. The pathologic changes observed were simple conjunctival irritation, acute conjunctivitis, chronic catarrhal conjunctivitis, sometimes limited to the bulbar portion exposed between the lids, eczema of the lids, and three instances of bilateral pterygium.

E. M. Blake.

Rebello Machado, Nicolino. Contribution to tropical Brazilian ophthalmology. *Rev. Brasileira Oft.*, 1946, v. 5, Sept., pp. 5-15.

The first part of the article gives two cases of direct wasp sting in the

sclera and the cornea respectively. The former was in a 12-year-old black girl. The vision of the affected eye was completely abolished. There was a severe iridocyclitis with hypopyon and diminished tension. The sting had occurred 7 mm. outward from the limbus. Later probing through the 2-mm. opening at this point suggested the presence of intrabulbar suppuration. At evisceration, the vitreous was found completely disorganized and purulent.

The second case occurred in a 34-year-old male Brazilian Negro. The cornea was stung but not completely penetrated at the five o'clock position, 2 mm. from the limbus. Vision, at first reduced to light perception, returned to normal, and only a slight nebula remained at the site of the injury. Both cases occurred along the coast, and probably both were due to the wasp *Synoecca Surinana*.

The second part of the paper deals with injury by toxic vegetable substances that occur especially in woodsmen, usually when engaged in cutting down trees. The most frequent offender appears to be a member of the family Euphorbiaceae, probably ophthalmoblapton pedunculare Muell, known by the local inhabitants as Cega-Miguel or Cega-Maria (Blind Michael or Blind Mary). This and similar plants possess a caustic sap or latex. Two cases are reported in woodsmen aged 23 and 34 years respectively, who had been engaged in cutting down trees in the forest, and received splashes of the sap in one eye. In each the vision, at first considerably disturbed by the effect on the cornea, returned more or less definitely to normal. Other offenders are the tree euphorbia called Uassacú, the oil of the castor plant, Podophyllin, and Jequirity. The products of these

plants are not infrequently used for simulation. (References.)

W. H. Crisp.

Stallard, H. B. Retinal detachment due to war trauma. *Brit. Jour. Ophth.*, 1946, v. 30, July, pp. 419-429. (See Section 10, Retina and vitreous.)

Webster, J. E., Schneider, R. C., and Lofstrom, J. E. Observations upon the management of orbitocranial wounds. *J. Neurosurg.*, 1946, v. 3, July, pp. 329-336.

A survey of 40 cases of orbitocranial wound was made. In 20 patients (Group 1) the globe was injured, requiring enucleation, and in 20 (Group 2) the bony orbit was involved with varying degrees of injury to the functions of the globe.

Patients in Group 1 required the enucleation of one or both globes, a procedure which may be done to advantage before the cranial wound is attacked. The use of implants after enucleation depended upon the degree of disorganization of the orbital contents.

Twelve patients in Group 1 presented varying types and degrees of intraocular injury with complete or incomplete loss of vision. In eight patients the vision was normal. The predominant disturbance that resulted in loss of vision was of vascular origin. The commonest findings were vitreous and retinal hemorrhages with tearing and detachment of the retina. Proptosis of the globe was frequently present with these lesions. In one patient the detachment of the pulley of the superior oblique muscle was disrupted. In another, total blindness resulted from a fragment that entered the roof of the orbit posteriorly. Evaluation of the type and degree of damage

to the globe and the optic nerve by either the fragment or the concussive effects of injury was difficult to make in the early period of management.

Massive wounds of the orbitocranial wall were satisfactorily managed by means of a temporary graft of fascia lata applied to the dural defect. An osteoplastic frontal craniotomy flap exposure was effective in dealing with wounds in this area in some cases. Complicating brain abscesses were treated by an "open" method using a graft of fascia lata to close the dura temporarily and isolate the brain from the sinuses. A split thickness graft was applied to the wound after removing the temporary fascial graft.

Theodore M. Shapira.

Zolotnizki, I. I. Perforating ocular injuries. *Oftal. Jour. (Odessa)*, 1946, pt. 2, pp. 25-29.

Fifteen cases are reported to show the gravity of ocular perforations associated with injuries of the skull, and the necessity for careful diagnosis before doing an enucleation, in order to avoid fatal meningitis. The author urges that every ocular perforation associated with injury to the superior orbital wall be regarded as an intracranial injury, with obligatory X-ray and neurological examination.

Ray K. Daily.

17

SYSTEMIC DISEASES AND PARASITES

Agesta, R. S. Ophthalmomiasis with the larva of *Oestrus ovis*. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Sept., pp. 791-796.

Two cases are reported. In one the larvae were identified by the Institute of Parasitology, and in the other the

diagnosis was made from the history. The author believes the patients are entitled to compensation because the infection occurred while the men were at work. (2 illustrations.)

Ray K. Daily.

Bellora, Aldo. Unilateral exophthalmos as a sign of deterioration in a case of progressive atrophic myopathy of the humero-scapular region (Erb). *Riv. Oto-Neuro-Oft.*, 1941, v. 18, Nov.-Dec., pp. 457-474.

A 28-year-old farmer developed exophthalmos (12-mm. protrusion) of his right eye with pseudo-Graefe, Moebius, and Stellwag signs. Gifford's sign was present, the pupils were equal and normal in all reactions. Parenteral administration of prostigmine resulted in a unilateral miosis, temporary loss of light reaction and near vision produced further pupillary narrowing. Two hours after prostigmine administration, both pupils again were equal. Progressive atrophic myopathy of the scapulo-humeral type was found. Etiology and pathogenesis are discussed. (3 figures, bibliography.)

K. W. Ascher.

Bietti, Giambattista. Rare and atypical forms of cranial and craniofacial dysostosis with ocular complications. *Boll. d'Ocul.*, 1945, v. 24, April-June, pp. 83-136.

The writer reports four cases of dysostosis of the bones of the skull and face. A girl 13 years of age showed marked acrocephaly, the disappearance of cranial sutures, basilar lordosis and flattening of orbits. The digits of her hands and feet were of the Marfan type and this was present in different members of her mother's family. A symptom that she had in common with the mother was the tortuosity of the

retinal vessels and with the father the myelinated fibres at the optic disc. The other three observations were made in a family among the members of which the mother, a son, and a daughter had dysostotic changes of the skull and face. The mother showed more marked lesions in the right half of the head and had exostosis of the skull. The son showed a craniofacial dysostosis of the Crouzon type and the daughter showed an atypical dysostosis with syndactyly. Three other children were free from symptoms. Among the ocular lesions common to all, the writer mentions exophthalmos, divergent strabismus, and optic atrophy. The writer classifies the form of craniofacial dysostosis. (Bibliography, 19 figures.)

Melchior Lombardo.

Bookstaver, P. I. Horner's syndrome. *U. S. Naval Med. Bull.*, 1946, v. 46, April, p. 567.

The author describes a classical Horner's syndrome, noted within 24 hours after the patient was wounded by a Japanese bullet that penetrated the right side of the neck. There was also a bruit in the neck which suggested a traumatic arteriovenous aneurysm.

Benjamin Milder.

Cavara, Vittoriano. The ocular manifestations of herpetic infection. *Boll. d'Ocul.*, 1946, v. 25, Jan.-June, pp. 3-296.

The subject is comprehensively discussed in 13 chapters: 1, the generalities of herpetic infection, 2, herpetic manifestations in the eye in general, 3, herpetic eruption of eyelids, 4, herpetic manifestations of the conjunctiva, 5, herpes of the cornea, 6, herpetic lesions of sclera and episclera, 7, of the uvea, 8, of the optic nerve, 9, of the ocular nervous apparatus, 10, ocular

lesions from herpetic virus and other associated germs, 11, diagnosis of ocular herpetic manifestations, 12, prognosis of ocular herpetic manifestations, and 13, therapy and prophylaxis of the ocular herpetic manifestations. Each chapter has a bibliography. (119 figures.) Melchior Lombardo.

Cockayne, E. Dwarfism with retinal atrophy and deafness. *Arch. Dis. Childhood*, 1946, v. 21, March, pp. 52-54.

The author describes a sister and a brother first in 1936 and again in 1946. The condition, which is probably recessive, appears to be a definite entity not previously described. It is characterized by dwarfism with prognathism, thickening of the skull bones, and other skeletal changes, a peculiar form of retinal pigmentation, optic atrophy, and cataract, deafness, and mental deficiency. Theodore M. Shapira.

Duggan, W. F. Vascular basis of allergy of the eye and its adnexa. *Arch. of Ophth.*, 1946, v. 36, Nov., pp. 551-611.

This excellent paper is essentially a monograph of the literature of the allergic manifestations in all the tissues of the eye.

To most physicians allergy means "hypersensitivity" to protein, whether of plant, animal or bacterial origin. The author includes all those aseptic or abacterial lesions in which the basic pathologic process can be reduced to the common denominator of either increased capillary permeability or excessive contraction (spasm) of smooth muscle or both. The only difference between the normal and the allergic person is one of degree. Every one probably has minor or transitory allergic manifestations during life. Al-

lergic patients have more severe and more frequent attacks of allergy.

The relation of histamine to allergy is discussed in detail. Allergy of the ocular tissues can be interpreted as a manifestation of localized vascular dysfunction. This vascular dysfunction causes areas of localized tissue anoxia. Anoxemia is not usually, or necessarily, present.

Vasodilator therapy, which acts by relieving the tissue anoxia, seems to be of value in the treatment of the allergic lesions of the eye. This treatment is based on the pathologic physiology of the lesions. R. W. Danielson.

Duke-Elder, Sir Stewart. Nutritional aspects of ophthalmology. *Irish J. Med. Sc.*, 1946, 6th series, June, pp. 177-189.

The author describes the ophthalmologically important vitamins A, B, C, and D and the affects of vitamin deficiencies on the various structures of the eye. Theodore M. Shapira.

Gabardi, E. F. and Zanello, D. Oculomedullar syndrome caused by a metastasis of a pancreatic carcinoma. *Riv. Oto-Neuro-Oft.*, 1941, v. 18, no. 3, pp. 199-244.

A 9-year-old boy developed bilateral choked discs, proptosis, severe chemosis, blindness and immobility of both eyes, and later nodules beneath the skin of his face and neck. It was not until six months later that the primary lesion, a pancreatic carcinoma, produced clinically recognizable symptoms. A flaccid paraplegia occurred two days before death. Extensive carcinomatous infiltration of the spinal leptomeninges was found at necropsy. (33 illustrations, more than 150 references.) K. W. Ascher.

Gorduren, S. Conjunctival findings in cases of cold haemagglutination. *Brit. Jour. Ophth.*, 1946, v. 30, Oct., pp. 613-616.

The conjunctiva of two patients suffering from cold haemagglutination were chilled by the application of cold isotonic salt solution. The temperature of the salt solution varied from 37 to 0 degrees centigrade. The vessels underwent marked constriction with agglutination of the red cells. The blood columns became segmented. At 27 degrees this occurred in 45 seconds and the vascular pattern returned to normal in 45 to 60 seconds. At the freezing point the phenomenon developed in 3 to 5 seconds and disappeared in 150-170 seconds. Morris Kaplan.

Lopez, P. M. Ocular symptoms and complications of epidemic cerebrospinal meningitis. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Oct., pp. 871-883.

The material for this study comprises 102 patients, of whom 57 had ocular complications. It is pointed out that ocular complications are recorded principally on patients who were examined by ophthalmologists. Pediatricians or internists are apt to overlook ocular symptoms. In as much as the conjunctival sac may be the initial site of infection with the meningococcus, Lopez urges that during epidemics cultures for the meningococcus should be made in all cases of conjunctivitis. People exposed to the disease should be watched.

The severity of the ocular symptoms appears to be proportional to the severity of the disease, and Lopez divides the cases into severe, moderately severe, and mild. The tabulated data show that among the severe cases, which constituted 25 percent of the

total number, there were three of amaurosis with normal fundus and pupillary reactions, caused by the toxic action on the higher visual centers; three of spasmodic strabismus; two with conjugate deviation; four with rigidity; eight with Goppert's sign, which is a pupillary dilatation in response to slight stimulation of the skin; two with papillitis due to a descending neuritis; one of papillary edema caused by an inflammation of the choroidal plexus; one of keratitis, not of the neuroparalytic type; two cases of endophthalmitis.

In the moderately severe cases, which represent 35 percent, the predominating complications were transient optic neuritis, transient strabismus due to involvement of the sixth nerve, muscular rigidity, Goppert's symptom, and irido-cyclitis. In the mild cases, constituting 42 percent, the ocular complications were insignificant.

The author's experience confirms the prevalent opinion that the most effective therapy is intensive administration of sulfa drugs and lumbar punctures. In cases of endophthalmitis and panophthalmitis hemotherapy with the blood of parents was used in addition to sulfatherapy and with benefit; the parents were first saturated with sulfa drugs and their blood, mixed with a foreign protein, was injected intramuscularly. Ray K. Daily.

Pirisi, B., and Mesina, R. Lawrence-Moon-Bardet-Biedl Syndrome. *Riv. Oto-Neuro-Oft.*, 1941, v. 18, Sept.-Oct., pp. 361-420.

An extensive review of 152 cases published up to 1941 is presented, and two (brother and sister) observations of his own are reported. These two patients had retinitis pigmentosa sine pigmento, hemeralopia, nystagmus,

adiposity, genital dystrophy, mental debility, mongoloid faces, and dental anomalies, but no polydactyly, except for one foot which had six toes. (12 figures, bibliography.)

K. W. Ascher.

Rossi, V. Reticulo-endotheliosis in ophthalmology. *Arch. di Ottal.*, 1946, v. 50, Jan. and Feb., pp. 1-19.

Rossi reviews the literature on the reticulo-endothelial system in general medicine and ophthalmology. One patient is described who had a generalized glandular enlargement and nodules in both upper fornices. There was a monocytosis of 25 to 27 percent. In the diagnosis the syndrome of Heerfordt and Mickulicz disease, both diseases of the reticulo-endothelial system were considered. The diseases of Nieman-Pick, Gaucher, and Christian-Schüller are in the same group.

Another patient was thought to have involvement of the choroid by mycoses fungoides. There were edema of the papillae, moderate hemorrhages and extreme dilatation of the veins, a papulous erythema of the lids, intense hyperemia of the conjunctiva, and enlargement of the preauricular gland. Later this patient returned. He was amaurotic, and in the yellow fundus, all landmarks were completely erased. The similarity to von Hippel-Lindau disease without cystic degeneration and detachment but with proliferation of the reticulo-endothelial elements of the retina and the neuroglia is noted.

Francis P. Guida.

Wagener, H. P. Temporal arteritis and loss of vision. *Am. J. Med. Sc.*, 1946, v. 212, Aug., pp. 225-228.

Inflammation of the temporal artery occurs in those of advanced age and is probably a local manifestation of a

systemic arterial disease. In about one third of the patients there is loss of vision. In some the visual loss arises from central artery closure, in others venous phlebitis in the retina with hemorrhages and exudates.

Johnson, Harley, and Horton suggested the possibility of a direct extension of the lesion from the temporal arteries into the arteries of the optic nerve. They found that vasodilator drugs were harmful. The loss of vision may be out of proportion to the visible changes in the disc and retina. Sudden complete blindness with a normal fundus may be due to ischemic or anoxic retrobulbar neuritis. The ophthalmoscopic lesions fall into three groups: closures (thrombosis) of the central artery of the retina or of branch arterioles, ischemic optic neuritis, and indeterminate. The neuritic type is the most common.

More general recognition of this syndrome will help to explain sudden complete or partial loss of vision in elderly individuals. Retinal arterial closure with atypical visible lesions should make one suspect temporal arteritis. Loss of vision during the stage of active inflammation when the temporal arteries are cordlike and tender, pain on fatigue on chewing makes the diagnosis easy. If visual loss occurs late a history of inflammation of the temporal arteries helps in diagnosis.

Francis M. Crage.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Allen, T. D. A small plant industrial eye program. *Trans. Amer. Acad. Ophth.*, 1946, May-June, pp. 205-210.

Ophthalmic examinations and placement programs for employees based

on these examinations have not been suitable financially for smaller plants of 200 to 500 employees. The Illinois Society for the Prevention of Blindness made available the services of a safety engineer, illuminating engineer, and a visual survey technician at the cost of one dollar per employee examined. These examinations were made in several small manufacturing plants and the results were very satisfactory. The accident rate was materially reduced after the examinations were made and corrective measures were adopted. Chas. A. Bahn.

Anastossoff, A. The scientific and social work of Constantin Pascheff. *Revue Bulgare d'Ophth.*, 1943, v. 2, pp. 1-34.

This is a detailed review of Professor Pascheff's numerous papers and an evaluation of their importance for general pathology, as well as for every branch of ophthalmology. His contributions towards an improvement of the Public Health Service and the service for the visually handicapped and blind in Bulgaria are emphasized. (References.) Alice R. Deutsch.

Cisney, Harland N. Vision testing in an automotive accessories industry. *Trans. Amer. Acad. Ophth.*, 1946, March-April, pp. 170-174.

Four thousand individuals were examined visually at 26 feet and 13 inches. Visual acuity with both eyes together and with each eye separately as well as phorias, vertical and lateral, depth perception, and color discrimination were measured at 26 feet and visual acuity and phorias at 13 inches. It was found that 75 percent of those who passed the approved visual standards were rated as good operators whereas only 33 percent of those who

did not meet the standards were rated as good operators. Wall charts for testing distant vision are less efficient than modern mechanical methods if properly used. Chas. A. Bahn.

Cooper E. L. A method for classifying employees for selective placement. *Trans. Amer. Acad. Ophth. and Otolaryng.*, 1946, Jan.-Feb., pp. 135-139.

Only near and distant visual acuity is needed for the routine examination of employees in industry. The combined visual efficiency of the two eyes is then computed in accordance with the formula of the A.M.A. committee on compensation for eye injuries. All examinees are divided into three groups: physically qualified (P.Q.), not physically qualified (N.P.Q.) and physically qualified with exceptions (P.Q.X.). Those who are rated N.P.Q. are not visually eligible for any position. Those rated P.Q. are eligible for positions ranging from the lowest to the highest visual requirements. Special examinations such as those for muscle balance, color perception, and depth perception are made for examinees qualifying for positions requiring these tests. The group P.Q.X. includes those who have handicaps which exclude them from some occupations but not all.

The system has the advantage that it can be readily adapted to the requirements of any employer without special medical personnel or special testing equipment. It eliminates unnecessary routine testing but provides supplementary tests in specific fields of effort. Charles A. Bahn.

Dickson, R. M. A statistical analysis of persons certified blind in Scotland. *Brit. Jour. Ophth.*, 1946, v. 30, July, pp. 381-405.

In this complete, detailed study of the 7,297 registered blind of Scotland many interesting facts are found. Causes of blindness in order were: cataract, 17.1 percent; myopia, 14.9 percent; chronic septicemia, 10.8 percent; syphilis, 10.0 percent; glaucoma, 8.1 percent; injury, 5.9 percent. Since the first two appear latest in life, they accounted for fewer years of blindness while such causes as congenital anomalies, ophthalmia neonatorum, and congenital lues accounted for 44.5 percent of the total years of blindness. The highest incidence is among miners, metal workers, spinners, and weavers. In Scotland, a person is legally blind if he has less than 3/60 vision or the visual fields contracted to 10 degrees although the vision may be 6/60 or better. (22 tables.)

Morris Kaplan.

Ehlers, Holger. *The Causes of Blindness in Denmark*. Jour. of Social Ophth., 1946, v. 3, July, pp. 23-28.

Smallpox, trachoma, ophthalmia neonatorum, scrofula, and xerophthalmia (during World War I) have been eliminated as causes of blindness. The causes now are congenital anomalies such as malformations, microphthalmia, congenital cataract, retinitis pigmentosa, amotio retina, and optic atrophy. There has been a great increase in the number of patients with weak eyesight in the past ten years, whereas the number of patients attending a school for the blind show a marked decline. I. E. Gaynon.

Gradle, H. S. *Graduate training in ophthalmology—Jackson Memorial Lecture*. Trans. Amer. Acad. Ophth. and Otolaryng., 1945-46, Sept.-Oct. pp. 10-14.

The evolution of graduate training and the accomplishments of the American Board of Ophthalmology are reviewed. The need of standardized ophthalmic training between the completion of the intern year and certification by the Board is emphasized. The plan recommended would include training in basic science for three to six months at a university and medical school. In this course laboratory demonstrations and directed conferences and quizzes would be of first importance. The basic training would be followed by a period of clinical training of not less than two years. This would be given preferably in special university hospitals or general hospitals, if a sufficient staff could be secured. Conferences and seminars would take up major and important subjects. If possible, this training should lead to a degree and automatic certification by the American Board of Ophthalmology. Chas. A. Bahn.

Jablonski, Walter. *Ophthalmological impressions in the Orient*. Ophthalmologica, 1946, v. 112, July, pp. 39-46.

Jablonski visited Palestine, Egypt, and Cyprus. He noted a preponderance of external eye diseases and their resulting deformities. Koch-Weeks conjunctivitis breaks out with surprising regularity and vehemence about three months after the last rains and is often complicated by corneal ulcer. It is usually followed by an epidemic gonorrhoeal ophthalmia which in the Orient is transmitted from eye to eye and causes most of the blindness. Toward the end of the summer an epidemic conjunctivitis is observed that resembles swimming pool conjunctivitis. It occurs more frequently in the coastal plains than in the mountains.

Throughout the year one sees vernal conjunctivitis, diplobacillus conjunctivitis, and the ubiquitous trachoma. The latter usually is treated surgically. Fly larvae in the conjunctival sac are found occasionally. Corneal fistulas, descemetocoele, (following corneal ulceration) and purulent dacryocystitis are common. Metasyphilitic eye symptoms are rare, perhaps because the population is infected with malaria. Tobacco-alcohol amblyopia is almost never seen. Early cataract formation seems to be common and certainly glaucoma, often starting in youthful age, is relatively frequent. All hereditary degenerations and malignant myopia are common, probably because of marriage among blood relatives. (References.)

F. Nelson.

Massoud, F. Egypt's contribution during the war to protection against disease through care of eyes of babies. *Brit. Jour. Ophth.*, 1946, v. 30, Oct., pp. 617-622.

A program of prevention of trachoma and ophthalmia was carried out, so successfully that in many areas 70 to 90 percent of the eyes of children are normal and in some public schools all pupils have healthy eyes. (3 tables.)

Morris Kaplan.

Minton, Joseph. Ophthalmic problems and visual standards in industry. *Brit. Jour. Ophth.*, 1946, v. 30, May, pp. 298-303.

A plea is presented for more widespread and more intelligent use of routine ophthalmic examinations in industry.

Morris Kaplan.

Neubert, F. R. Ophthalmic experiences in the Royal Air Force. *Brit. Jour. Ophth.*, 1946, v. 30, Oct., pp. 601-606.

A statistical analysis of the results of the ophthalmic examination of candidates for air crew duties is reported. The tests done were visual acuity, manifest hyperopia, cover test, Maddox rod, Bishop Harman test, convergence, accommodation, visual fields (confrontation), color vision and fundus examination.

Morris Kaplan.

Pöleff, L. Necessity of an international study center of trachoma. *Brit. Jour. Ophth.*, 1946, v. 30, May, pp. 287-290.

The author presents a plea for the establishment in Morocco of an international center for the study of trachoma, the greatest medical scourge of the world today.

Morris Kaplan.

Pollock, W. B. I. Arabian ophthalmology. *Brit. Jour. Ophth.*, 1946, v. 30, Aug., pp. 445-457.

An interesting, detailed history of ophthalmology in Arabia and Persia from the 9th through the 13th century is presented. Of most interest was the operation for cataract in which the surgeon inserted a small hollow tube into the lens and sucked up as much of the contents as possible.

Morris Kaplan.

Redway, L. D. Plant experience with metallic stencils. *Trans. Amer. Acad. Ophth.*, 1946, Jan.-Feb., pp. 139-141.

Metallic stencils used for addressing mail must be checked before and after use, which requires a high degree of binocular function, accurate depth perception, and manual cooperation. The stencils act as metal mirrors which cause uncomfortable flashing reflections. Overhead fluorescent lighting of 65 foot candles at working height and the wiping of the stencils with a quick

drying ink materially reduced these ocular symptoms. The author believes that the usual visual screening methods should not be interpreted too rigidly.

Chas. A. Bahn.

Reed, H. Incidence of trachoma in the Southern Highlands Province of Tanganyika. *Brit. Jour. Ophth.*, 1946, v. 30, Oct., pp. 573-580.

This study attempts to explain the definite geographic variation of trachoma among the Africans. The incidence among all natives in this province was about 50 percent and yet it varied from 13 to 87 percent in the various districts. The disease was generally mild and uninfluenced by climate or other geographic factors. Occupation which determined the state of personal cleanliness seemed important. The incidence was greatest where raising of cattle brought flies.

Morris Kaplan.

Reeh, M. J., Stimmel, E. W., and Heagan, F. V. A motor-driven ophthalmotrope. *Amer. Jour. Ophth.*, 1947, v. 30, Jan., pp. 58-59. (3 figures.)

Rodin, Frank H. *Eserine: its history in the practice of ophthalmology*. *Amer. Jour. Ophth.*, 1947, v. 30, Jan., pp. 19-28. (7 figures, references.)

Sbikowski, Enrique de. Prevention of ocular accidents. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Jan., pp. 82-84.

The author asks that failure to carry out protective measures should be recorded in the case records of traumatic accidents. The ease with which serious accidents can be avoided should be explained to the injured. The importance of preëxisting diseases, especially of dacryocystitis, in the aggravation of otherwise minor injuries should be

pointed out and dacryocystitis should be included in the list of reportable diseases. He advocates preliminary visual examination as a means of vocational adjustment, the correction of defects and refractive errors, and the elimination of agents injurious to the human eye from the home, the school, and industry.

Ray K. Daily.

Smith, F. L. Visual skills analyzed brings results; a plant experience. *Trans. Amer. Acad. Ophth.*, 1946, March-April, pp. 174-175.

A direct correlation was found between visual skills in successful employees and their lack in employees who failed. Since the introduction of a visual examination and follow-up program, complaints of eye strain in positions demanding visual skills have markedly diminished.

Chas. A. Bahn.

Sorsley, A. Nineteenth century provincial eye hospitals. *Brit. Jour. Ophth.*, 1946, v. 30, Sept., pp. 501-546.

This comprehensive historical account of all the eye hospitals in the British Isles in the nineteenth century reveals the fact that 52 such hospitals were founded and used and only 18 of them remain today.

Morris Kaplan.

Souza, J. L. de. Luzia, protector of the eyes. *Arquivos Brasileiros de Oft.*, 1946, v. 9, April, pp. 49-64.

According to the ecclesiastical record, Santa Luzia (or Lucia) was a Christian virgin who underwent martyrdom in Siracusa in the year 304, in the Diocletian persecution. She appears to be referred to in an epitaph found in Saint John's catacombs (Siracusa), and her name is attached to a Mass in the Gregorian Sacrament

(A.D. 590-604). Her remains were removed from the Siracusa catacombs to a cathedral dedicated to her at Corfino in the dukedom of Spoleto, and later were taken to Metz. Although usually depicted as carrying in her hands a tray on which are seen two eyes, there is nothing in the history of her life and death to suggest anything connected with eyes. It is possible that confusion has arisen from the fact that her saint day is the same as that of Saint Odilia, who is said to have been born blind and to have recovered her sight upon baptism by the Bishop of Ratisbon. (References.)

W. H. Crisp.

Stump, F. N. How ophthalmic eye care can prevent many industrial accidents. *Trans. Amer. Acad. Ophth.*, 1946, July-Aug., pp. 219-225.

The author believes that 98 percent of industrial accidents are preventable. Based on an Ortho-Rater examination in numerous plants a statistical resume is given and a pattern of requirements is made for different vocations. Three separate groups are compared. Sixty more employees in the accident-free group had standard visual acuity than in the seriously injured group. In the accident-free group 68 percent more had standard depth perception than in the seriously injured group. New employees farthest below visual standards had 75 percent more accidents than those who were acceptable.

Chas. A. Bahn.

Swanson, C., and Stewart, R. A. Causes of blindness in U. S. Naval and Marine Corps. *U. S. Naval Med. Bull.*, 1946, v. 46, April, p. 520.

The causes in 119 cases of bilateral blindness, and 640 cases of unilateral blindness, reported in the U. S. Navy

and the Marine Corps during World War II, until January 1, 1945 are classified. Of bilateral blindness, 60 percent, and of unilateral, 50 percent, was traumatic and due to enemy action. Sixteen percent of the bilateral blindness resulted from methyl alcohol poisoning.

Benjamin Milder.

Taylor, W. O. G. Occupational therapy in eye wards. *Brit. Jour. Ophth.*, 1946, v. 30, Aug., pp. 456-461.

The author indicates the usefulness of occupational therapy in eye wards and lists nine crafts that are suitable for eye patients who need occupational therapy. Special warning is given to omit basketry because of its general association with blindness. (6 illustrations.)

Morris Kaplan.

Tiffin, J., and Wirt, S. W. Determining visual standards for industrial jobs by statistical methods. *Trans. Amer. Acad. Ophth.*, 1945, Nov.-Dec., pp. 72-93.

Visual requirements for employment may be based on arbitrary opinions of standards required and on statistical facts which determine the necessary minimum requirements for a specific position. By the statistical method the selection of better workmen is facilitated, employees with different visual skills can be allocated to appropriate jobs; and those with inferior visual skills can be employed productively rather than be denied employment based on rigid arbitrary standards. With periodic testing, losses in visual skills are disclosed and their correction may be accomplished before production or safety is affected. The increased demand for the services of an ophthalmologist is also mentioned.

Two methods of segregating workmen and making statistical compari-

son of their visual skills are used: (1) "Follow-up" method in which all new employees on a specific job are tested and the results tabulated for future analysis; (2) the testing of present employees on a job, classifying them on the basis of quantity and quality of production. The results of such investigations make possible appraisal of the visual requirements of any specific position.

Chas. A. Bahn.

Tolman, C. P. Eye conservation and increased production. *Trans. Amer. Acad. Ophth.*, 1946, July-Aug., pp. 225-230.

Conservation and utilization of eyesight in industry is a profitable investment. Two out of five workers have visual deficiencies which prevent their best possible work and in 90 per cent of them the vision can be made satisfactory by glasses. Adequate lighting will increase production. A proper color scheme will lessen fatigue, increase production, and increase the efficiency of lighting. Minimal visual requirements should be determined for any specific position and all employees should have a visual test.

Chas. A. Bahn.

Wheeler, J. R. History of ophthalmology through the ages. *Brit. Jour.*

Ophth., 1946, v. 30, May, pp. 264-275.

This rather inclusive paper covers 4,200 years of ophthalmology.

Morris Kaplan.

Yousefova, F. I. A. G. Vasutinski, a great scientist. *Oftal. Jour. (Odessa)*, 1946, pt. 2, pp. 3-7.

A. G. Vasutinski, who was director of graduate study in ophthalmology at the University of Kiev, is eulogized.

Ray K. Daily.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Franceschetti, A., and Valerion, M. Associated malformations of the eyes and ears. *Confinia Neur. Basek*, 1944-45, v. 6, no. 5, pp. 255-257.

The association of malformation of the eyes and ears is rare. The author presents a case of bilateral microphthalmus and corneal opacity in a patient whose ears had external deformities. A brother had a similar condition. The malformation of the eyes probably developed in the seventh or eighth week of embryonic life, while the ear condition developed about four months before birth.

O. H. Ellis.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
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News items should reach the editor by the 12th of the month

DEATHS

Dr. Reuben Bennett Anderson, Jr., Fort Worth, Texas, died January 2, 1947, aged 52 years.

Dr. Enga Mitchell Arnold, Houston, Texas, died November 1, 1946, aged 64 years.

Dr. Morris Louis Harris, Brooklyn, New York, died November 28, 1946, aged 59 years.

Dr. William Edward Patterson, Minneapolis, Minnesota, died October 30, 1946, aged 71 years.

Dr. Charles Tiffany St. Clair, Bluefield, West Virginia, died November 17, 1946, aged 73 years.

Dr. George N. Seidlitz, St. Louis, Missouri, died November 5, 1946, aged 85 years.

Dr. Samuel Anise Shoemaker, Orlando, Florida, died November 6, 1946, aged 80 years.

Dr. Andres Jay Timberman, Columbus, Ohio, died October 15, 1946, aged 82 years.

MISCELLANEOUS

VETERANS' ADMINISTRATION PROSTHESES

The Army's plastic artificial eye has been used by more than 7,500 former soldiers during the past three years and has been adopted by Veterans' Administration in furnishing ocular prostheses to patients, the War Department announced recently.

Developed first in 1943 by a former major in the Army Dental Corps while stationed in England, this type of acrylic eye has practically replaced glass eyes which were used almost exclusively before World War II. The Army Medical Department developed this eye after the war broke out, when both civilian and military supplies of artificial eyes were depleted due to high breakage and inability to replenish supplies. Glass eyes then used in the United States were largely German-made.

As early as 1943, the Army made plans to discard the easily breakable, inferior, custom-made glass eye when Major (then Lieutenant) Stanley F. Erpf of San Francisco, California, assigned to the job by Col. Derrick T. Vail, Consultant in Ophthalmology in ETO, successfully demonstrated the artificial eye made of water-clear plastic and individually fitted and colored. In January, 1944, the first training center for ophthalmoprosthetists was organized at the 30th General Hospital, England. Forty American dental officers and 10 British dental officers attended.

Dr. Robert E. Stewart, Chief, Ophthalmoprosthetic and Restoration Division, Prosthetic Appliance Service, Veterans' Administration,

said today that all 15 technicians making artificial plastic eyes for Veterans' Administration are Army-trained. They were dental officers and technicians especially trained in this work during the war.

"The Army-developed artificial eye has proved superior to any other type of ocular prosthesis available today," Dr. Stewart declared. "Of about 500 World-War II veterans who have applied to the Veterans' Administration for ocular prosthesis aid, none had any serious complaint about the acrylic eye. They wanted lost eyes replaced, socket corrections, or needed refitting because of other operations."

Dr. Stewart said the Army-developed eyes were never broken when dropped nor had the coloring in the eyes deteriorated. He explained that some eyes had become roughened due to hard usage, but this was easily remedied.

SCHOLARSHIP FUND ESTABLISHED

The Delta Gamma fraternity, an international organization of college women, announces the establishment of a fund for scholarships in the fields of Prevention of Blindness and Sight Conservation exemplified by specialized prevention study, training of orthoptic technicians, training of teachers for sight-saving classes, and training of workers for the preschool blind.

Information on basic qualifications for the various fields will be sent upon request. Application blanks may be obtained from Mrs. Richard P. Miller, 39 West Jefferson Road, Pittsford, New York.

Advising the fraternity's council and project committee in the selection of candidates and administration of the fund is a professional committee consisting of: Dr. LeGrand Hardy, Chairman, president of the American Orthoptic Council; Mrs. Virginia S. Boyce, administrative assistant, National Society for the Prevention of Blindness; Miss Ruth E. Lewis, professor of social work, George Warren Brown School of Social Work, Washington University; Miss Ruth B. McCoy, assistant director, New York State Commission for the Blind; Dr. Lillian Ray Titcomb, president, Executive Committee, Nursery School for Visually Handicapped, Los Angeles.

SOCIETIES

READING SPEAKER

The Reading Eye, Ear, Nose, and Throat Society, Reading, Pennsylvania, had as speaker

for the January meeting, Dr. Benjamin F. Souders, whose topic was "Some Recent Developments Regarding Enucleation, Modern Implants and Prostheses, with Particular Reference to the Cutler and Reudemann Techniques."

MILWAUKEE MEETING

The annual meeting of the Milwaukee Ophthalmic Society was held on January 28th. Dr. Erwin E. Grossman of Milwaukee was the ophthalmic speaker. His paper, "Gonioscopy and Glaucoma," was the thesis he presented for membership in the society. Dr. J. B. McBean of the Mayo Clinic spoke on "Observations in the Management of Vasomotor Rhinitis."

TEXAS SOCIETY OFFICERS

At the December meeting of the Texas Society of Ophthalmology and Otolaryngology held in Dallas, Dr. W. E. Vandevere, El Paso, was elected president; and Dr. E. D. Dumas, San Antonio, was elected secretary. The next annual meeting of the society will be held at Houston in December, 1947.

WASHINGTON GUEST SPEAKER

The Washington, D.C., Ophthalmological Society had as guest speaker for the January meeting, Dr. Charles E. Iliff of the Wilmer Institute, Johns Hopkins University. He spoke on "Beta Irradiation in Ophthalmology."

A case presentation was given by Dr. M. Noel Stow on "Pseudoxanthoma Elasticum with Angioid Streaks: The Syndrome of Groenblad and Standberg." Two case presentations were given by Dr. Ralph N. Greene, Jr.; one on "Possible Tumor of the Macula," the other on "Multiple Cholesterol Deposits of the Retina." Dr. Edward J. Cummings spoke on "Epithelioma of the Lid," and Dr. A. J. Delaney spoke on "Pigment Proliferation or Benign Melanoma."

ANNOUNCEMENT

OREGON POSTGRADUATE COURSE

The Oregon Academy of Ophthalmology and Otolaryngology announces its eighth annual spring postgraduate course to be held in Portland, April 7 to 12, 1947. A fine program has been arranged by the Oregon Academy and the University of Oregon Medical School.

Dr. John Dunnington, professor of ophthalmology at Columbia University, New York, and Dr. George Shambaugh, professor of otolaryngology at Northwestern University Medical School, Chicago, will be the guest speakers.

There will be lectures, clinical demonstrations, and ward rounds. In order to make the course more personal and practical, registration will be limited to 125. Further information may be obtained from Dr. Harold M. U'ren, secretary, 1735 North Wheeler Avenue, Portland 12, Oregon.

PERSONALS

During February, Dr. Arthur Linksz continued the series of lectures and demonstrations on "Physiological and Geometrical Optics," at the Manhattan Eye, Ear, and Throat Hospital, New York.

Ben A. Ramaker and Ivan L. Nixon have been appointed managers of the Bausch & Lomb Optical Company's ophthalmic and instrument divisions. Raymond H. Andersen was named to succeed Ramaker as head of the company's ophthalmic sales, and Lysle B. McKinley was appointed successor to Nixon as manager of the firm's instrument sales division.

Dr. Trygve Gundersen has been appointed assistant professor of ophthalmology at the Harvard Medical School.

Dr. H. Saul Sugar is now located at 2311 David Broderick Tower, Detroit 26, Michigan.

TYPES OF CONGENITAL CATARACT*

THE SANFORD R. GIFFORD MEMORIAL LECTURE

FREDERICK C. CORDES, M.D.

San Francisco

I appreciate very highly the great honor you have conferred upon me by asking me to present the Sanford R. Gifford Memorial Lecture. May this presentation be worthy of that honor.

To have known Dr. Sanford R. Gifford as a scientist, an ophthalmologist, a teacher, and a clinician was an inspiration. His modest, unassuming bearing, combined with his consideration of others, endeared him to all who came in contact with him. To have known "Sandy" Gifford as a colleague, as a companion of the trail, and a campmate at the Bohemian Grove was a rare privilege. Indeed, these memories are among my most cherished.

I have taken as my subject a discussion of the various types of congenital cataracts, a condition that I have been interested in for a number of years. It also seems a particularly appropriate topic because of Dr. Gifford's interest in the subject; he having written three papers on congenital cataracts, two in the American and one in the German Literature. In addition, he and Dr. Latta, in 1923, discussed what is now referred to as retrolental fibroplasia or persistence and hyperplasia of the primary vitreous.

A thorough knowledge of congenital

cataracts is essential for the proper interpretation of slitlamp findings and for an intelligent discussion of the condition with the patient or the patient's parents. Inasmuch as most congenital cataracts are stationary and cause no interference with vision, this knowledge makes it seem wise often not to tell the patient of his condition and thus avoid a great deal of unnecessary worry. This knowledge also permits an intelligent discussion of the prognosis and treatment in cases of the more extensive type of congenital cataract when parents bring their children to the ophthalmologist at an early age. In addition, it is possible in certain instances to assure the parents that in all probability future siblings will not have the same anomaly.

Certain forms of congenital cataracts show an hereditary tendency. These seem to be primarily the dominant type. The type may not always be consistent so that lamellar, polar, spindle, and central cataracts all may occur in the same family. In some instances, however, the type may be the same in all members of the family involved. Haro,¹ for example, observed a family of 59 persons, covering four generations, in which 16 members had ring or disc-shaped cataracts. Atypical forms have been observed through several generations.

It is noteworthy that in 50 percent of the cases of congenital cataract other ocu-

* From the Division of Ophthalmology, University of California Medical School. Read at the Chicago Ophthalmological Society meeting, January 20, 1947. Art work made possible by funds from the Mrs. E. S. Heller Donations.

lar disturbances are present. These include strabismus, amblyopia, nystagmus, aniridia, choroidal and retinal changes, microphthalmus, and other anomalies.

With the introduction of the slitlamp and corneal microscope, our knowledge of congenital cataracts has been enriched by

As pointed out by Ida Mann,² a certain number of congenital abnormalities can be explained as abnormal persistences of a normally transient condition. But it must also be borne in mind that a greater part of so-called developmental anomalies do not represent any normal stage, but

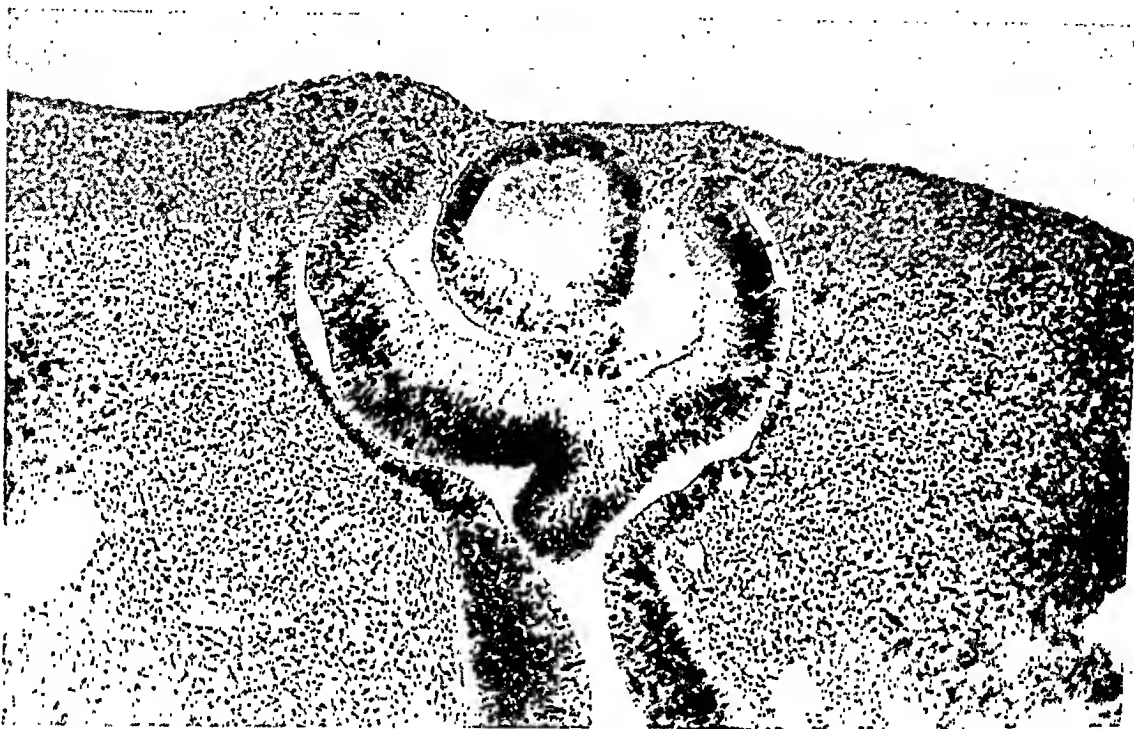


Fig. 1 (Cordes). Section through the eye of a 7- to 8-mm. human embryo (four weeks). The fetal fissure is still open, and the lens vesicle is still connected to the surface. Cells of the posterior wall of the lens vesicle are beginning to elongate. The so-called "epitrichial" cells are enclosed in the lens vesicle.

the systematic study of the lens as seen with the widely dilated pupil. Thus, we know that there are many fine congenital cataracts that were unknown to older observers, and which are only visible to us now because of the slitlamp. A clear lens, one in the sense of a good photographic or microscope lens, is probably nonexistent in the human eye, as practically all lenses, even those of young children, show some punctate or dustlike opacities. How many of these opacities were present before birth and how many may have developed in the first few years of life is naturally a difficult thing to judge.

are pure aberrations of growth. The most that can be said in regard to the production of these developmental anomalies is that it is possible to deduce from their location and to place accurately the time at which the fibers involved were formed. Whether the opacities occurred at this initial time or whether they occurred as the result of a subsequent degeneration, it is impossible to say.

EMBRYOLOGY OF THE LENS

Some knowledge of the embryology of the lens is necessary for a proper understanding of the biomicroscopy of the

lens. The lens arises from ectoderm. In a 4.5-mm. human embryo Ida Mann³ was able to identify the lens plate. According to Ida Mann⁴ this formation is followed by a symmetrical indentation of the lens plate to form the lens pit. This in turn invaginates to form the lens vesicle which is complete by the 7- to 8-mm. (fig. 1)

sure is still open (fig. 2). The primary lens fibers now fill half of the lens vesicle. At the 18-mm. stage (7 weeks) the fetal fissure is closed and the cavity of the lens vesicle is almost filled. The hyaloid artery and the tunica vasculosa are present at this stage. By the 26-mm. stage (8 weeks) the primary fibers are complete (fig. 3).

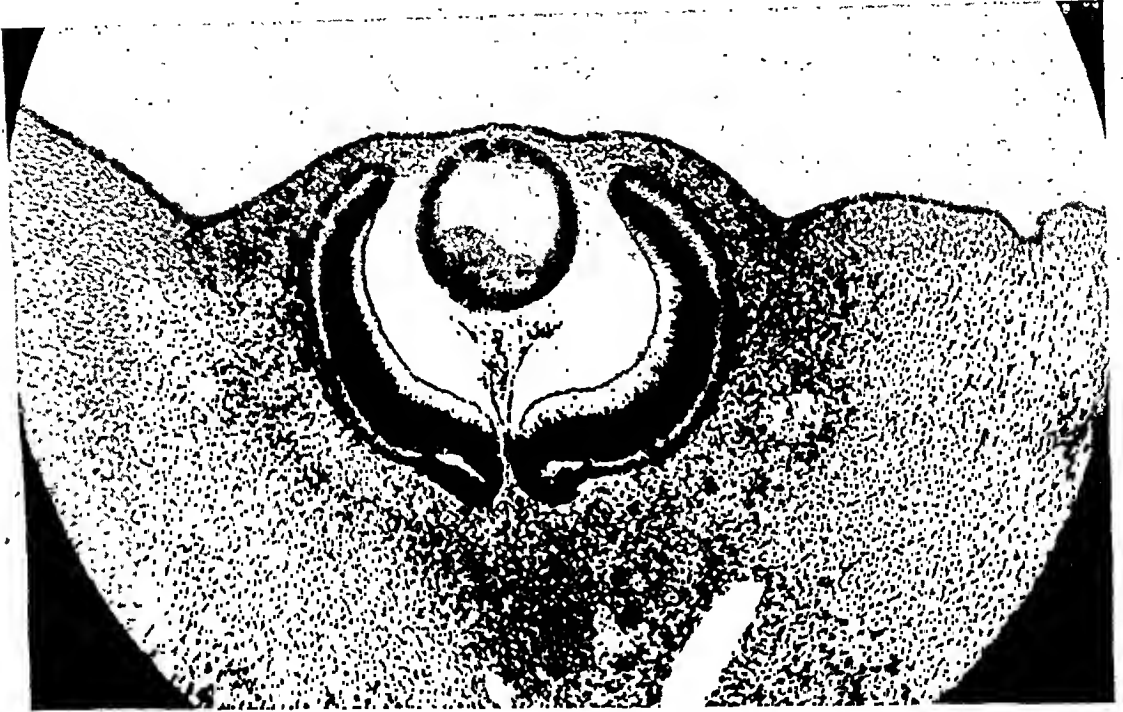


Fig. 2 (Cordes). Section through the eye of a 10-mm. (five weeks) human embryo. The lens vesicle has separated from the surface. Further elongation of the cells of the posterior wall is evident, and there is a decrease in the enclosed epitrichial cells. The hyaloid artery is present and the tunica vasculosa lentis is beginning to appear.

stage; however, the vesicle is still connected to the surface. The primary lens fibers now begin to form from the cells of the posterior wall. It must be remembered that the whole adult lens is formed from the cells of the posterior wall and the equatorial region, the anterior wall of the lens vesicle taking no part in the formation of lens fibers. During this stage, the tunica vasculosa lentis also begins to form. By the time the 10-mm. stage (5 weeks) has been reached, the lens vesicle is separated from the surface but the fetal fis-

These primary fibers remain at the exact center of the lens throughout life, and form the embryonal nucleus. Where these fibers come in contact with the fibers from the opposite side they form the lens sutures, the anterior erect Y and the posterior inverted Y. During this time the lid buds also make their appearance. In the 65-mm. stage (11 weeks), we find that the embryonic nucleus is now surrounded by the secondary lens fibers. Bowman's and Descemet's membranes are also present in the cornea, and the lids have formed.

The secondary fibers continue to form throughout life by division of cells of the equatorial region. The complicated pattern of sutures causes these fibers to become closely merged. These patterns differ and their surfaces possess slightly different indices of refraction, so that, by using the slitlamp, the various stages of

of this elaborate vascular system surrounding the lens atrophies and disappears between the seventh and ninth months, but remnants of it can often be seen even in old age in a large number of people. The anterior part, or pupillary membrane, persists relatively late. Ida Mann⁵ described this as seen both in sec-

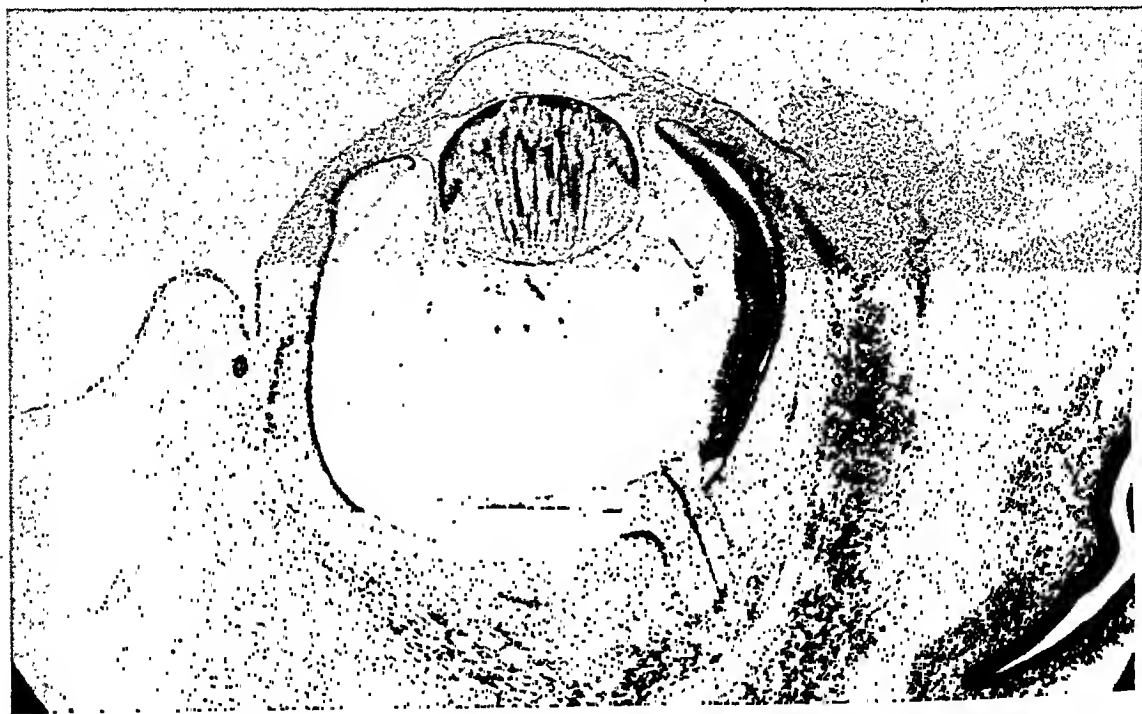


Fig. 3 (Cordes). Section through the eye of a 30-mm. embryo. The formation of the primary lens fibers is complete, and the embryonic nucleus is formed. In the equatorial region, the secondary fibers are forming. The anterior chamber is present, and the tunica vasculosa is complete. The lid buds are present.

development can be determined (fig. 4).

The tunica vasculosa lentis is a capillary network that surrounds the lens during its development. It is derived from the hyaloid artery and appears during the fifth week. As the hyaloid artery develops, it branches throughout the primary vitreous to form the posterior part of the tunica vasculosa lentis. The central part of the network is formed from vessels that come in from the upper edge of the optic cup and from the equatorial portion. The anterior part is derived from the vascular system of the iris. Practically the whole

tion and as it appears in fetal eyes of five to nine months as observed with the slitlamp. The failure of this atrophy may have a bearing on retrolental fibroplasia.

Any arrest of development causes changes in the lens. Those changes occurring before the fourth week are more profound, and the result is gross abnormalities of the eye itself. Those changes that occur between the fourth and sixth weeks result in gross abnormalities of the various structures of the eye. Mann⁶ states that delay of closure and separation of the lens vesicle from the surface ectoderm

permits the lens fibers to grow forward and protrude through the opening in the capsule with a resultant anterior-capsular opacity. The failure of the development of lens fibers from the cells of the back wall of the lens vesicle leads to an absence of the central portion of the lens and results in the formation of a congenital disc-shaped cataract.

portion of the lens that is formed before the third month.

2. *Fetal nucleus* is the term applied to the zone between the embryonic nucleus and the next reflecting surface. This nucleus begins to be formed in the third month and is formed during intrauterine life.

3. *The adult nucleus* is enclosed by the

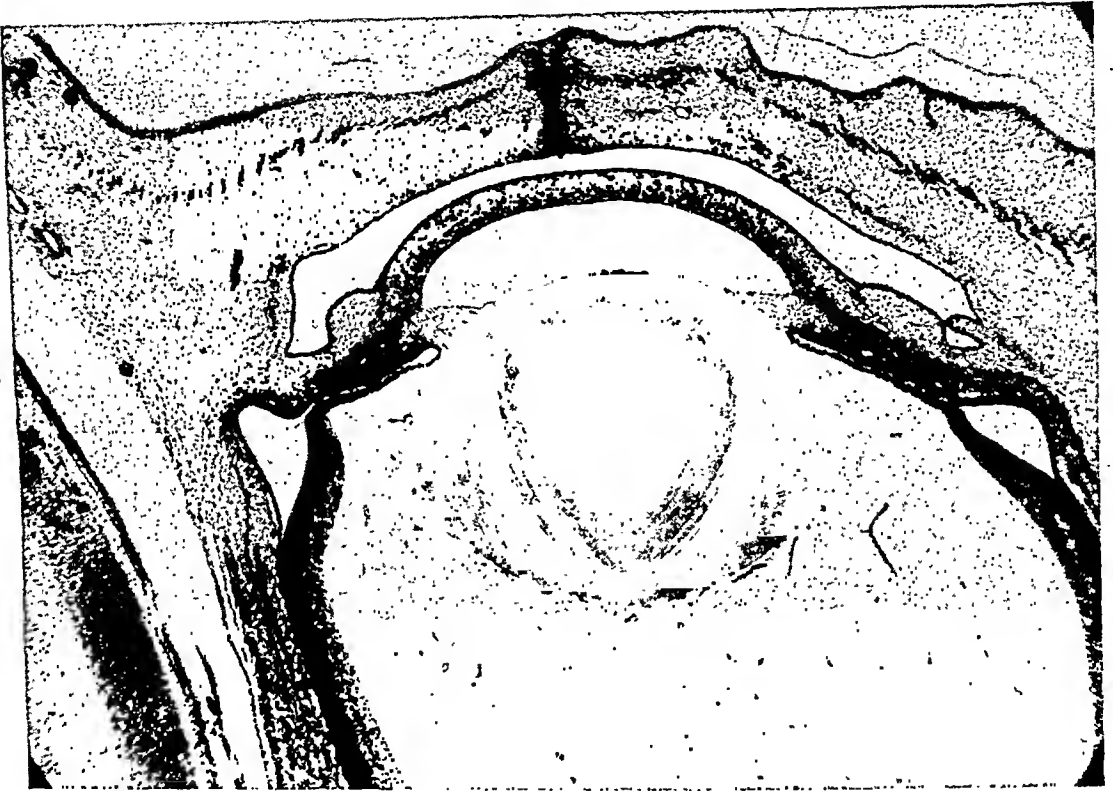


Fig. 4 (Cordes). Sagittal section through the eye of a 65-mm. (11 weeks) embryo. The embryonic nucleus is surrounded by the developing secondary fibers. The cornea with Bowman's and the beginning of Descemet's membrane is present. The formation of the lids is complete.

The diagnosis of congenital cataracts is to a great extent dependent upon biomicroscopy of the lens. With the fine beam of the slitlamp and the corneal microscope, the suture lines and certain surfaces representing stages in the development of the lens are visible throughout life. Four zones can easily be differentiated.

1. *Embryonic nucleus*. This is the central layer between the Y sutures and is the

next reflecting surfaces and will later become the lens of adult life. It is formed during adolescence and early adult life.

4. *A cortex* covering these various strata and consisting of fibers laid down in later life forms the next layer which is its largest in old age.

These layers are covered by the lens capsule and anterior epithelium. Just nasal to the posterior pole of the lens the hyaloid artery attaches itself for a time to the

lens capsule and sends branches over its surface (*tunica vasculosa lentis*). At 8½ months it disappears, but persists as a corkscrewlike thread (hanging into the vitreous) which may be seen with the slit-lamp in adult life. At times its attachment

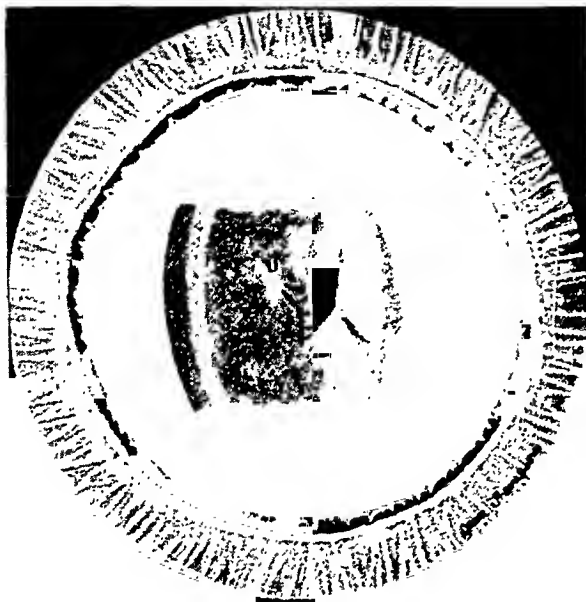


Fig. 5 (Cordes). Anterior axial embryonal cataract.

may be seen with the ophthalmoscope as a fairly large dot, the posterior lens dot, and is sometimes referred to as a posterior-lens cataract. This form does not interfere with vision as it is always located slightly nasal to the posterior pole.

During life, the lens continues to increase in size by the growth of new lens fibers from the cells just beneath the capsule, which are the only ones to retain their nuclei. These fibers are in turn displaced centrally by the development of other new fibers. Thus the subcapsular opacity left by an injury to the lens received in childhood is found in adult life to be located in the deeper layers of the lens and the period at which such an injury occurred can be determined rather accurately with the slitlamp.

CONGENITAL LENS OPACITIES

ANTERIOR AXIAL EMBRYONAL CATARACT

This is the most frequent form of congenital cataract. According to Vogt⁷ it occurs in approximately 25 percent of all individuals. The cataract consists of multiple fine opacities that are irregular in form and lie in close proximity to the anterior embryonal suture and usually at its exact level. In direct light these opacities appear as white, chalklike bodies which on occasion may have a crystalline appearance. The opacities are surrounded by a faint halo, and are usually multiple although they can occur as single opacities (fig. 5). They cause no interference with vision and, like all congenital cataracts, are stationary. The formation of this type of cataract probably occurs in the fourth embryonal month. Vogt⁷ says: "It is conceivable that the opacity has its origin in an early stage in which the cavity of the lens vesicle was becoming obliterated and the included cells were not absorbed." Ida Mann⁸ does not feel this is likely since any cell remnants in the cavity of the lens



Fig. 6 (Cordes). Stellate (sutural) cataract involving the anterior Y.

vesicle would be present either immediately under the anterior capsule or, conceivably, somewhere in the line of the anterior embryonic suture, but not behind or to either side of this. It is noteworthy that the anterior embryonal cataract is the only form of cataract that does not occur symmetrically in the anterior and posterior half of the lens.

STELLATE (SUTURAL OR TRIRADIATE) CATARACT

Vogt⁹ was the first to demonstrate that these congenital sutural cataracts occur in either the anterior or posterior suture, but more frequently the posterior (fig. 6). The sutures appear as white, thick lines extending as far as the branching and are accompanied by a varying-sized zone of opacification that is blue-green in color. The reverse color arrangement can also occur. These colors, which are also present in *cataracta cerulea*, are caused by the varying thickness of the opacities, the thinner having the greater tendency to the blue tint. Very thin opacities which are not visible in reflected light, appear blue-green in direct light in contrast to the yellowish lens. If these opacities are denser, they appear white. On rare occasions these clouded sutures appear in layers. This unusual condition is explained either by recurrent damage during the developmental stage or through the interposition of newly formed lens fibers. Duke-Elder¹⁰ believes that the stellate cataract develops subcapsularly during intrauterine life, probably about the time of birth. These cataracts are stationary, but the larger ones may interfere with vision.

PUNCTATE CATARACT (CATARACTA PUNCTATA)

Scattered small gray or light blue opacities are found in the extreme periphery of most young lenses. When these

opacities are scattered throughout the lens without involving the embryonal nucleus, they are called punctate cataract. This cataract must be differentiated from *cataracta coronaria* which may begin with light blue opacities in the equator of the

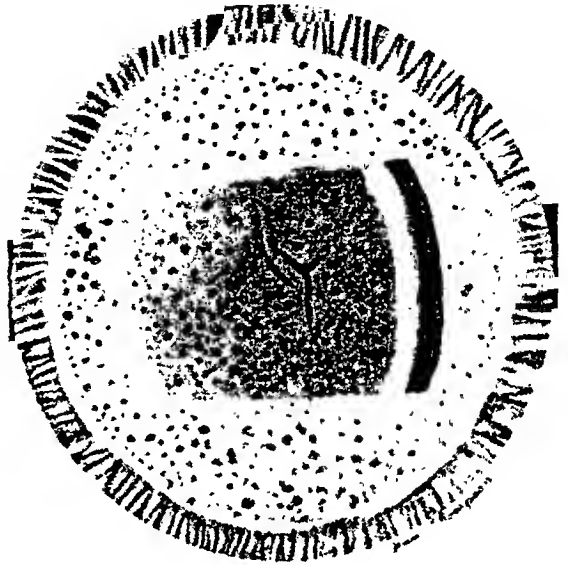


Fig. 7 (Cordes). Punctate cataract in which the opacities are scattered throughout the lens without involving the embryonal nucleus.

lens. According to Duke-Elder¹¹ an almost identical type occurs in Mongolian idiocy, in which condition it usually develops about puberty. True congenital punctate cataracts are very rare and may be associated with stellate cataract. Collins¹² felt that the opacities represent late-formed fibers which have undergone degeneration and have broken down into granular debris, and have then subsequently been surrounded by healthy fibers (fig. 7).

CONGENITAL OPACITIES AT THE ANTERIOR POLE OF THE LENS

Bellows¹³ classifies the congenital opacities of the anterior pole of the lens into three groups: (1) Anterior or pyramidal (central punctiform) cataract. (2) Capsular flakes. (3) Circular cataract.

1. *Anterior polar or pyramidal (central punctiform) cataract.* This cataract (fig. 8) consists of a sharply circumscribed opacity of the anterior lens capsule. The opacity varies greatly in size from pin-head to an opacity that may fill the pu-

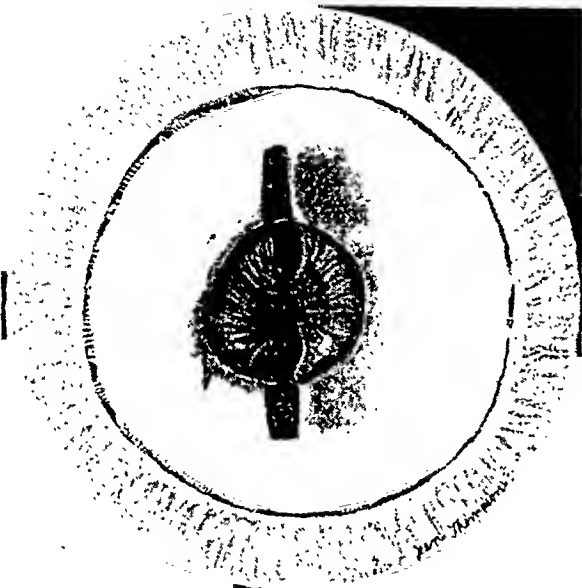


Fig. 8 (Cordes). Anterior polar (pyramidal) cataract.

pillary area. It is often laminated and is a conical projection in many instances, being sometimes directed toward the nucleus but usually projecting above the lens. According to Jess¹⁴ there may at times be a fine thread connecting the opacity to the cornea. This type of cataract is easily recognized by parents who then bring their children to the ophthalmologist. Not infrequently fine lines radiate from the opacity, and the cortex beneath may also be involved. The visual loss is dependent upon the size of the opacity; if this opacity is rather large, vision may be much better in dim light. Like most congenital cataracts the condition remains stationary in most instances, although Jess¹⁴ states that cases have been reported in which the opacity progressed to complete opacification. A simi-

lar form may follow small perforations of the cornea.

2. *Capsular flakes (Vogt-kapselstär-flecken).* Meesmann¹⁵ states that capsular flakes consist of white, oval or round, sharply circumscribed dense opacities that may be up to 1 mm. in size (fig. 9). They are frequently found associated with deeper opacities. The number of opacities varies but they are usually multiple. These opacities may appear as flat prominences on the capsular surface which, as Vogt¹⁶ pointed out, make the affected area lose its normal shagreen when examined with the slitlamp. Pigment threads or star-shaped pigment debris are frequently found in the area of the opacities. Inasmuch as the opacities are rarely axial, they cause no visual loss.

3. *Circular capsular or subcapsular cataract.* As stated by Bellows,¹⁷ circular capsular or subcapsular cataracts have been reported a number of times. The opacities vary in color from white, bluish white to "slightly brownish" in Gifford's¹⁸ case. The opacities may be round or radially placed. Pigment deposits and persistent pupillary membrane may also be present. In Gifford's case the opacity was

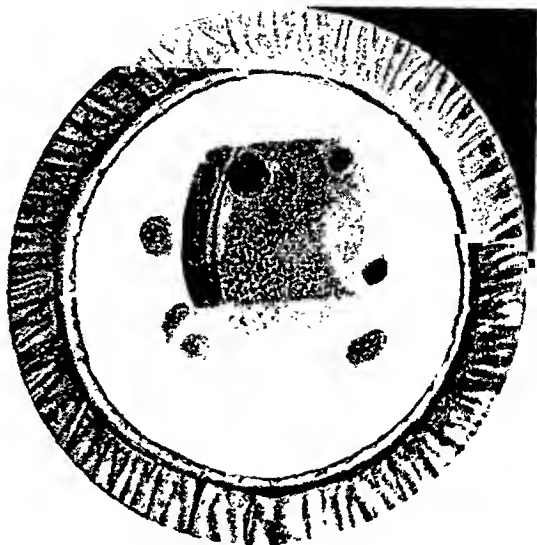


Fig. 9 (Cordes). Capsular flakes.

circular-and subcapsular and measured 1.5 to 2 mm. in diameter. The opacities were closest to the capsule at the periphery and in the center showed a "depression like the crater of a volcano." The vision may be surprisingly good, and was found to be 20/30 in Gifford's patient (fig. 10).

REDUPLICATION CATARACT

The development of this interesting form of anterior lens opacity has been described by Ida Mann.¹⁹ This condition shows that there has been an intrauterine or, more rarely, postnatal injury or defect of the anterior capsule together with involvement of a few of the lens fibers which were in direct contact with it. The lens fibers laid down after the initial disturbance may be relatively normal and may grow between the degenerated portion of the cortex and the capsular changes. This process results in a localized opacity of the anterior capsule with a similar opacity below it, but separated from it by normal lens substance. It is possible to place the time of the

original aberration by the depth of the reduplication from the lens surface (fig. 11).

POSTERIOR POLAR CATARACT

The posterior lens dot representing the remnant of the attachment of the hyaloid

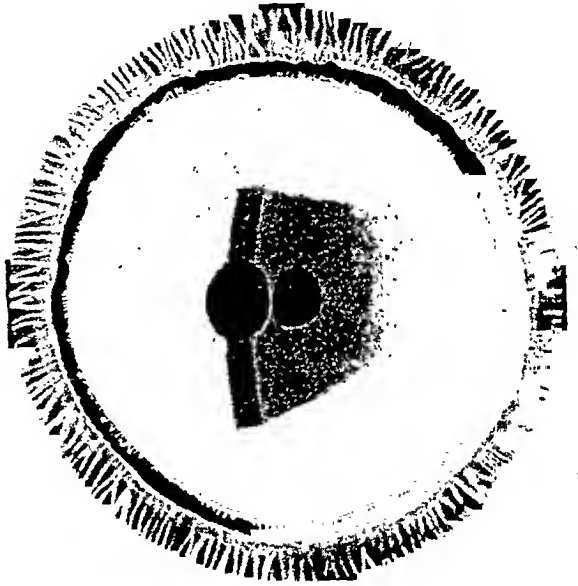


Fig. 11 (Cordes). Reduplication cataract.

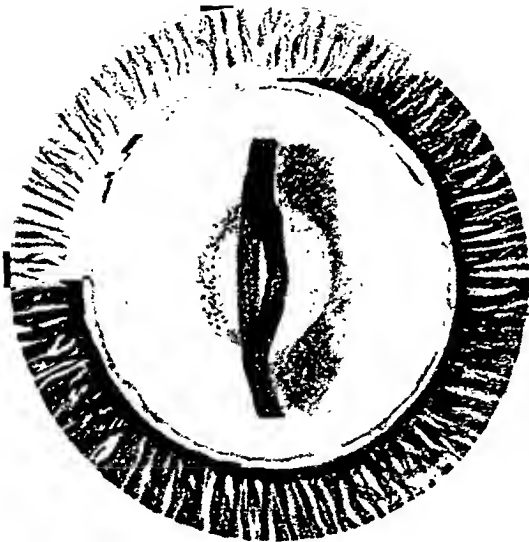


Fig. 10 (Cordes). Circular capsular or subcapsular cataract. (Reconstructed from Gifford. *American Journal of Ophthalmology*, 1924, volume 7, September, page 678).

artery is very common. At times there may be a large dense circular opacity covering the posterior pole, which represents a persistence of the fibrovascular sheath of the lens. Duke-Elder²⁰ feels that this condition can not legitimately be called a true cataract. A disturbance of the lens fibers directly beneath this may follow and in this way a localized posterior opacity may be formed corresponding to the anterior polar cataract. The opacity is confined to the capsule and the cortex just beneath it but it often causes marked interference with vision. When both eyes are affected, removal of the lens is indicated. Because of the fact that other anomalies are often present the prognosis must be guarded when surgery is considered.

POSTERIOR LENTICONUS

Posterior lenticonus is a rare anomaly in which there is a conical or globular protuberance on the posterior lenticular surface. Von Szily²¹ states that in addition to those cases in which there is an abnormal development of the posterior pole of an otherwise normal lens, there are some cases that are undoubtedly associated with the rupture of the posterior capsule. Vogt²² found that 80 percent of the cases reported were complicated by pos-

type that occurs within the first year of life. This cataract consists of a zone of lamellar opacities surrounding a clear, or almost clear, zone in the manner in which an orange peel surrounds the fruit. This zone of opacity is surrounded, in turn, by clear cortex. It is now a generally accepted fact that the opacity may occur either as a prenatal or a postnatal development. The size of the opacity varies and is dependent upon the state of development at the time of the lens damage; the earlier the disturbance the smaller the opacity. If involvement takes place at an early stage, the embryonic nucleus is surrounded by the opacity, but if it takes place during the last four months of pregnancy, the opacity will be within the fetal nucleus. Where opacification takes place after birth, the zone of the opacity will just surround the fetal nucleus.

The cataract appears as a round, gray, uniform opacity surrounded by a clear dark zone. It may be composed of fine white dots which according to von Szily²⁴ suggest a possible relationship to cataracta pulverulenta. There are thick, gray, radially placed U-shaped opacities, consisting of an anterior and posterior limb, that saddle the cataract in the equatorial region. At times, only part of the lens may be involved. Other parts of the lens may also be involved so that there may be fine punctiform opacities and opacification of the embryonic sutures. In addition, there may be a central embryonic nuclear opacity within the zonular opacity. At times there may be blossomlike opacities in the anterior portion of the cataract. The opacities have a tendency to increase in density rather than size and usually become stationary between 32 and 55 years of age. The size of the opacities has been given as between 5 and 8 mm. by von Bahr,²⁵ while von Szily²⁶ gives the figures as 2 to 8 mm. Von Arx²⁷ states that the thickness of the opacities varies between 0.5 and 0.7 mm.

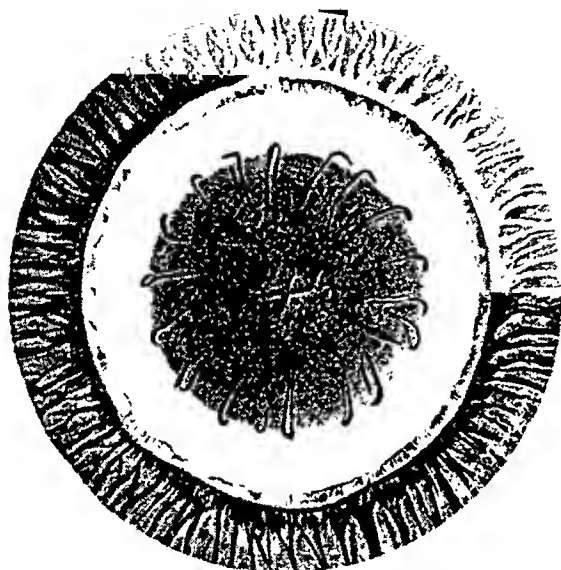


Fig. 12 (Cordes). Zonular (lamellar) cataract.

terior lens opacities, and, while persistent remnants of the hyaloid artery were by no means uncommon, they were situated slightly to the nasal side of the apex of the conus. The central part of the lens becomes highly myopic and causes dimness of vision. With the slitlamp, a ring reflex is seen which is often associated with a remnant of the hyaloid artery.

ZONULAR (LAMELLAR) CATARACT

According to Jess²³ the zonular cataract (fig. 12) is one of the most frequent types of congenital cataract if we include the

There is a marked hereditary tendency, inheritance being usually of the dominant type. The condition is nearly always bilateral and there is, as a rule, equal involvement of the two eyes. The vision varies between hand movements and 20/30, depending upon the size of the opacities.

In some of the congenital cases, the disturbance continues until birth, or is so unusually severe that the entire lens may be opaque. Under these conditions further growth of the lens fibers does not take place. This type is usually associated with other congenital defects of the eye, and any operative prognosis must be guarded.

Bellows²⁸ classifies zonular cataracts into three groups: (1) The congenital type showing an hereditary predisposition. (2) The type associated with tetany, appearing either in the first years of life, or originating later in life as a result of parathyroid deficiency. (3) A form resulting from local eye disease or trauma.

1. Congenital type. It has been frequently demonstrated that zonular cataracts may be congenital and may show marked hereditary or familial tendencies. The transmission of the cataracts is continuous, only those individuals having the anomaly transmitting it; and it is transmitted by either sex and is not sex limited. Bellows²⁸ feels that the most probable explanation of formation is the possible occurrence of convulsions in the mother or fetus, as hypocalcemia or even tetany are not unknown in pregnancy. In addition, the formation of these cataracts may be related to the greater demand for calcium during the last three months of intrauterine life.

2. Type associated with tetany. This is the most common type of zonular cataract and its association with convulsions during the first year of life has been an established fact for many years. Although rickets was at one time considered the

causative factor, tetany, has been established as the primary etiologic factor in the cataract development.

3. Resulting from local disease or trauma. The cataract has also often been observed after iritis, perforating corneal ulcer, contusions, and perforating injuries. Jess²⁹ reported the condition in a 13-year-old girl who, in the second year of life, had had a perforating injury with a needle.

As Hess³⁰ and others have pointed out,

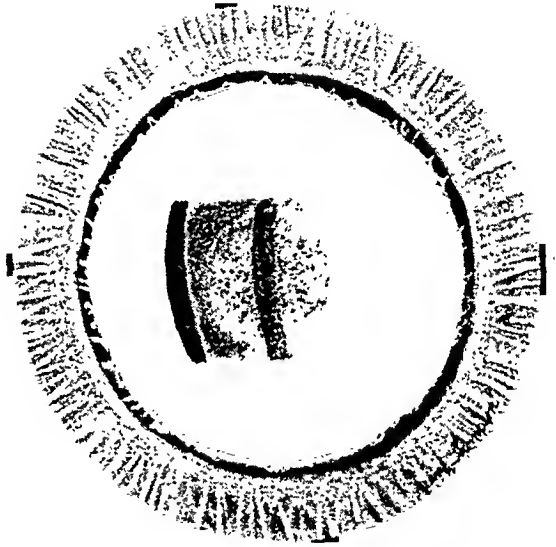


Fig. 13 (Cordes). Embryonal nuclear cataract (cataracta centralis pulverulenta).

it must be remembered that the etiology of these lens opacities is not always the same. It must also be remembered that tetany can cause nuclear, cortical, or total cataract.

If the opacity too greatly interferes with vision, surgery is indicated for these cases and linear extraction seems to be the chosen operation. In cases where there is a presence of nystagmus, one must give a guarded prognosis as to vision.

EMBRYONAL NUCLEAL CATARACT (CATARACTA CENTRALIS PULVERULENTA)

Poos³¹ and others believe that this cataract is related to the zonular cataract

for, even though it is smaller, the characteristics of zonular cataract may be present. Gifford³² also felt there was some relationship between this form and coraliform cataracts. The cataract consists of a fine gray-white opacity (fig. 13) lying between the anterior and posterior Y sutures, the embryonal nucleus. This fact makes it apparent that the disturbance occurred in the first three months of intrauterine life. The opacity is seen as a small gray globe in the otherwise clear lens. Under the slitlamp, its appearance has been described as resembling particles of dust seen in the sunshine. The condition is usually bilateral with a tendency for similar involvement in the two eyes. The condition is usually stationary, and the opacity measures 1.5 to 2.0 mm. The opacity may be rather dense. There is also a definite hereditary tendency. Nettleship and Ogilvie³³ found the condition in 20 members of one family. The cataract causes little interference with vision and Gifford³⁴ states that "operation is never required for opacity limited to the embryonal nucleus." Jess³⁵ observes that the embryonal nuclear cataract is often found in combination with the zonular cataract.

TOTAL CONGENITAL CATARACT

According to Jess³⁶ this is a relatively rare form of congenital cataract. Hess³⁰ feels that it differs from the embryonal nuclear cataract and the zonular cataract only in that a larger portion of the lens is involved. In addition to complete opacification, there are some cataracts in which a small portion of the lens may remain relatively clear. At times there may be a shrunken cataract. Usually both eyes have the same degree of involvement, although, at times, one eye may have a total cataract and the other a membranous type. Total cataracts have been observed that did not become entirely opaque until after birth. Particularly in those cases where there

has been a proliferative process of the tunica vasculosa, there is a tendency for later cataract development. The cataract may degenerate to the point of liquefaction so that it resembles a hypermature Morgagnian cataract. Even though the changes have taken place in intrauterine life, Mann³⁷ feels that the cause is probably a metabolic one which occurs near the end of fetal life.

MEMBRANOUS CATARACT

Jess³⁸ states that these cases are genetically related to total cataract. With absorption of the lens parenchyma during intrauterine life, the anterior and posterior capsule collapse to form a thin gray-white or chalky-white membrane. The presence of a deep anterior chamber associated with iridodonesis helps to make an easier diagnosis. The condition is frequently bilateral and often associated with other anomalies and with nystagmus and strabismus. In some cases there has apparently been an intrauterine iritis. Congenital lues has also received consideration as an etiologic factor. In a few cases the rupture of the posterior capsule has been demonstrated. While the condition is usually not considered to be hereditary, I have seen three members of one family with the same condition. In each case discission of the membrane resulted in useful vision, although all three had nystagmus.

FLORIFORM CATARACT

In 1923 Koby³⁹ described a rare form of congenital cataract to which he gave the name floriform (fig. 14). The opacity takes the form of annular elements, arranged either independently or grouped together like the petals of a flower. They are most commonly found in the axial portions of the lens, especially in the region of the fetal sutures. The condition shows a familial tendency, Koby report-

ing one family in which the mother and four children were affected. According to Meesmann⁴⁰ the opacities which are not visible in direct light are bluish-white to yellow as seen with the slitlamp.

AXIAL FUSIFORM CATARACT (SPINDLE CATARACT)

This cataract (fig. 15) was first described by Knies⁴¹ in 1877. The usual type consists of anterior and posterior polar cataracts united by threadlike opacities extending axially through the lens. According to Jess⁴² sometimes only the anterior or posterior part of the spindle may be present. The degree of interference with vision varies according to the amount of opacification present. The fusiform cataract is usually bilateral and the two eyes show equal involvement. This

strated by Collins⁴³ and others. Duke-Elder⁴⁴ feels these cataracts result from some disturbance in early fetal life which affects the axial area of the lens and inter-

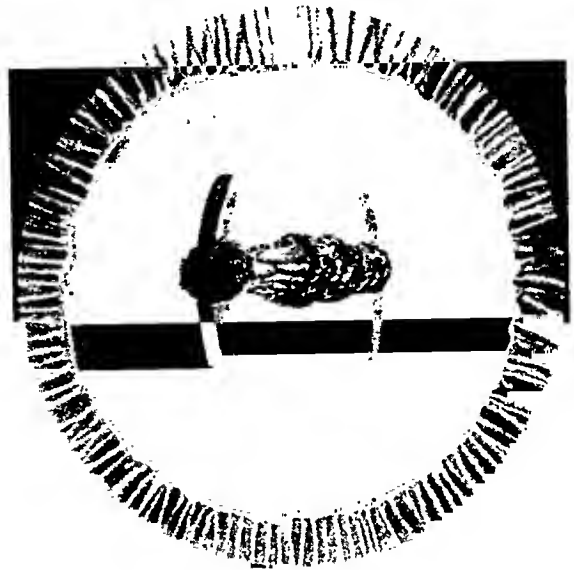


Fig. 15. (Cordes). Axial fusiform cataract (Spindle Cataract).

feres with the growth of new lens fibers in this region.

CORALLIFORM CATARACT

Coralliform cataract was the name given by Gunn⁴⁵ in 1895 to this unusual type of hereditary cataract. He described the cataract as composed of "rounded and oblong grey and white opacities seen grouped toward the center of the lens, so as to resemble a piece of coral growing forwards and outwards from this point." The condition has also been described by Nettleship,⁴⁶ Gifford,³² and others. In 1937 (fig. 16), Gifford and Puntenney⁴⁷ reported another case in which "irregular stellate or flower-shaped opacities extended forward to the anterior capsule and backwards to the posterior capsule, being connected with similar branching opacities involving all the layers of the lens in the axial area." The condition has a definite hereditary tendency, Nettle-

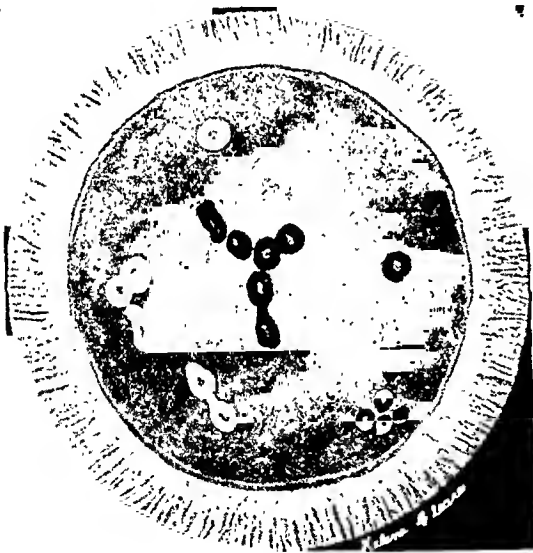


Fig. 14 (Cordes). Floriform cataract. (Drawn from Bellows. *Cataract and Anomalies of the Lens*, St. Louis, C. V. Mosby Co., 1944, page 274).

type of cataract shows a definite hereditary tendency. Embryonal nuclear, lamellar, and axial fusiform cataracts have been observed in the same family. An actual adhesion of the nucleus to the anterior and posterior capsule has been demon-

ship⁴⁶ having found 35 persons involved in five generations of one family.

Verhoeff⁴⁸ examined one of these lenses microscopically and found large masses of

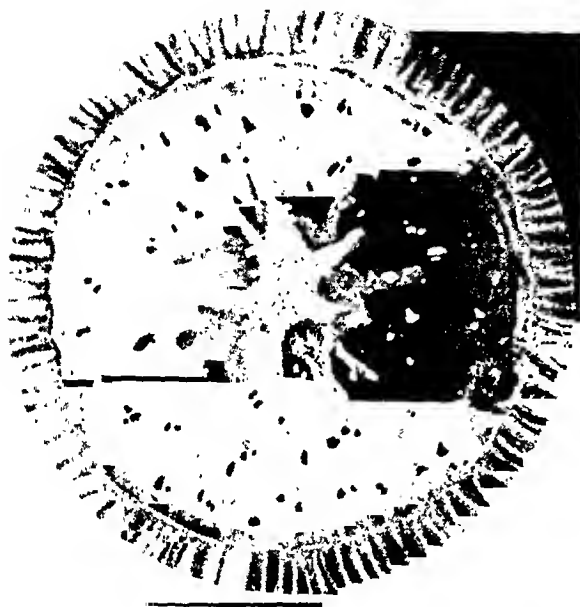


Fig. 16 (Cordes). Coralliform cataract. (From Gifford and Puntteney. *Archives of Ophthalmology*, 1937, volume 17, page 885).

crystals surrounded by areas of alterations in the lens fibers. The crystals consisted of rectangular and rhombic plates which showed the microchemical reaction of protein. These findings were confirmed by a case of Zentmayer's.⁴⁹ Nettleship assumed these cataracts to be identical in nature with spindle or fusiform cataract. Verhoeff⁴⁸ however, feels that the striking coral-like appearance and the distinctive crystals favor the opinion that the condition is entirely distinct from spindle or fusiform cataract. More recently, Mann⁵⁰ has grouped them all together and states that the axial fusiform cataract may arise by undue adhesion of the primary lens fibers to the anterior and posterior capsule while coralliform cataract involves the earliest secondary lens fibers which, failing to meet to form the anterior suture, remain wide open.

SPEAR CATARACT

Vogt⁵¹ described a type of cataract that he called "spear cataract" (fig. 17). In his case, spiky, branching opacities were seen running through the axial portion of the lens with no apparent relation to its anatomic structure. In places these opacities resembled insects; in other places the needlelike opacities showed a play of colors. In some instances, the crystals measured a millimeter in length and were arranged in bundles similar to tyrosine crystals. One lens which was extracted showed a predominance of cystein on chemical analysis. Gifford¹⁸ had a similar case in which the opacities were more regularly arranged so that they had the appearance of "two conventional fir trees placed base to base, the bases occupying the center of the lens." In 1937 Gifford and Puntteney⁴⁷ reported a case (fig. 18) in which the opacity was composed of crystals which resembled those of a spear cataract but were arranged in a more compact and circular mass. The central mass was just anterior to the anterior Y. A thin layer of cortex was present anterior to the outer zone of the crystals. The crystals were

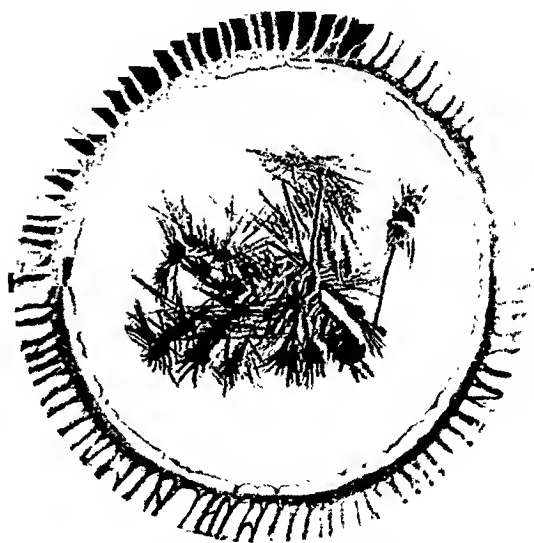


Fig. 17 (Cordes). Spear cataract of Vogt. (Drawn from Vogt, A. *Archiv für Ophthalmologie*, 1922, volume 107, page 237).

those of calcium sulfate. Gifford³² feels that these are all varieties of the congenital axial group of cataracts and states⁴⁷ that the reports indicate that chemical changes may occur in lenses belonging to the coraliform group that result in the formation of crystals in the lens.

SPIROCHETELIKE CATARACT

Koepp⁵² reported in 1921 an unusual type of congenital cataract that was bilateral and had fine lens opacities scattered through the lens. In the adult nucleus were some radiating opacities. The posterior pole showed an ill-defined disciform, conical opacity with its blunt tip directed toward the nucleus. In this area of the lens were numerous spirochetelike or corkscrewlike gray opacities that varied in size and thickness. During a 4½-year period of observation no change could be discerned (fig. 19).

DISC-SHAPED OR RING CATARACT

This rather rare and unusual congenital cataract, resulting from the absence of the

embryonic nucleus, has been described by Riedl,⁵³ Vossius,⁵⁴ Collins,⁵⁵ von Szily,⁵⁶ and others. The cataract consists of a depressed opaque central area surrounded

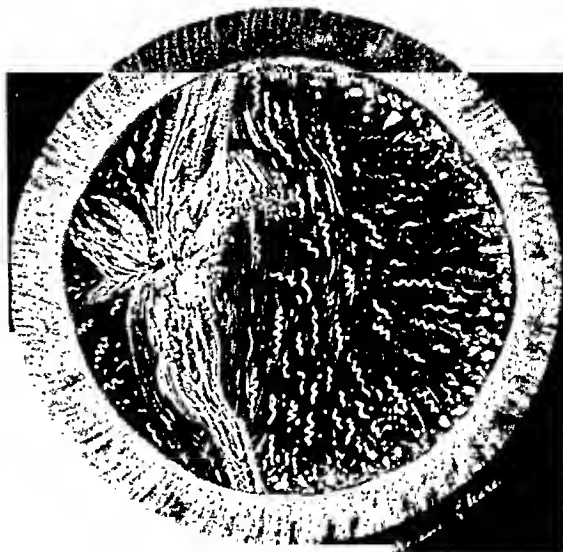


Fig. 19 (Cordes). Spirochete like lens opacities. (Modified drawing from Koepp, L. *Klinische Monatsblätter für Augenheilkunde*, 1922, volume 69, page 482).

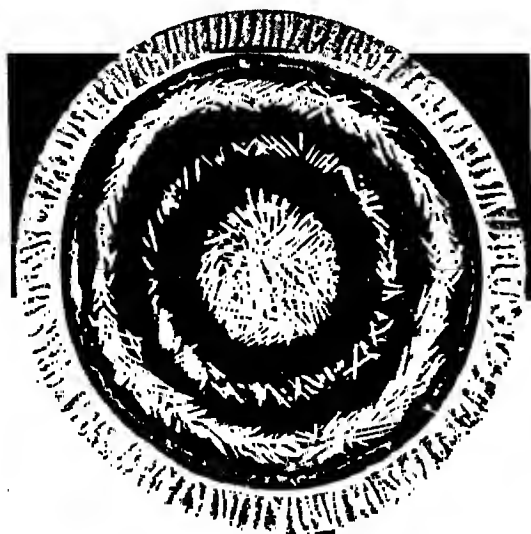


Fig. 18 (Cordes). Opacities composed of crystals resembling the spear cataract. (From Gifford and Puntenney. *Archives of Ophthalmology*, 1937, volume 17, page 885).

by a clear lens of normal size and thickness and forms a closed ring that has been described as resembling a life preserver (fig. 20). The depressed area in the center is not a hole, and there is no free communication between the anterior and posterior chamber. The central defect varies in size but never exceeds the diameter of the embryonic nucleus. In section, it appears as a dumbbell, having two lateral masses connected by a central band. In the pathologic examination of Haro's case⁵⁷ "the lens resembled a doughnut with a central, thinned, membranous area, 2.5 to 3 mm. in diameter, which was grey-white. The surrounding ring structure possessed the body of lens substance but showed yellowish opacities extending from the membranous portion toward the equator." In section the central area representing the axial portion was reduced to a membranous band about 0.5 mm.

thick, composed anteriorly of an intact, folded glass membrane. "A wavy glass membrane could be followed along the posterior surface from each outer margin but appeared to be absent or poorly formed centrally. Between these two membranes was a groundwork of a pale

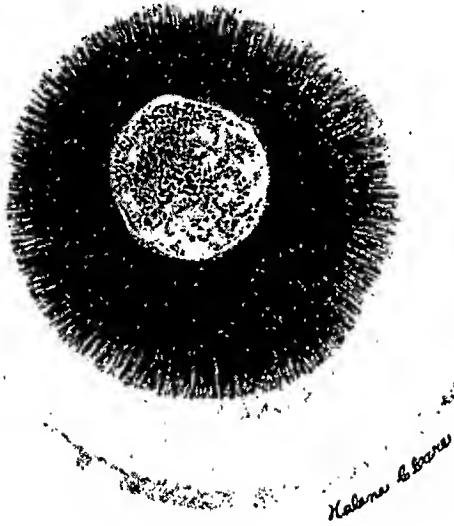


Fig. 20 (Cordes). Ring (disc-shaped) cataract (Modified drawing from von Szily, *Klinische Monatsblätter für Augenheilkunde*, 1928, volume 81, page 145).

eosinophilic, slightly fibrillar mass, in which could be found fusiform cells occurring in clumps."

While the lens substance within the ring is usually clear, there may be a zone of opacification resembling a zonular cataract.

There is a definite hereditary tendency in this condition; von Szily⁵⁶ has reported a family in which four members were affected. Haro⁵⁷ observed a family of 59 individuals covering four generations in which 16 members had congenital cataracts. In all members examined the cataract was of the disc-shaped type. Of this cataract, Ida Mann⁵⁸ says that the most logical embryologic explanation is that the nucleus, having failed to develop, shrinks

and calcifies and remains adherent to the capsule so that the outer fibers cannot grow around it but merely plaster themselves to the equatorial region. However, the initial cause is still unknown.

Aside from the congenital, familial disc-shaped cataract, there is another form described by Vossius,⁵⁴ Goldfeder,⁵⁹ Marchesani,⁶⁰ Wessely,⁶¹ and others; this is the so-called Soemmerring's ring. These cataracts may follow discission, corneal perforation, and, above all, perforating ulcers. The damage to the capsule must occur in the center of the lens during youth when the nucleus is still absorbable.

There are various surgical treatments for these cases. In many of these cases where the remainder of the eye is normal, a discission of the central membrane is usually sufficient. Collins,⁴³ in one case, was able to separate the central plaque, which fell into the anterior chamber where it remained without reaction. In two of his cases, Haro⁵⁷ found the membrane so tough that it was necessary to make a keratome incision and cut the central membranes with de Wecker scissors. Total extraction must be considered with caution because of the fact that in some of these cases the central plaque is adherent to the hyaloid membrane.

CONGENITAL CATARACT AFTER RUBELLA (GERMAN MEASLES) IN THE MOTHER

In May of 1944, Reese⁶² reported three cases of congenital cataracts in infants born of mothers who had rubella in the first month of pregnancy. This report followed the original ones of Gregg⁶³ and of Swan and his co-workers⁶⁴ when an epidemic of rubella in Australia called the prevalence of this condition to their attention. Since that time, over 200 cases have been reported and now the entity is well-established. I have never been able to find one instance of lens abnormalities where

the rubella was contracted after the third month. Typical findings personally observed in a child, aged nine years, suggests that the condition is not a recent one.

In addition to having lens changes, these children are small, ill-nourished, and difficult to feed. A high percentage show

clearer peripheral zone. In the second type, the entire lens is opaque. The process involves all but the outermost layers of the lens and is considered to have begun early in embryonic life.⁶² The condition is usually bilateral; in three cases personally observed, the noncataractous eye showed

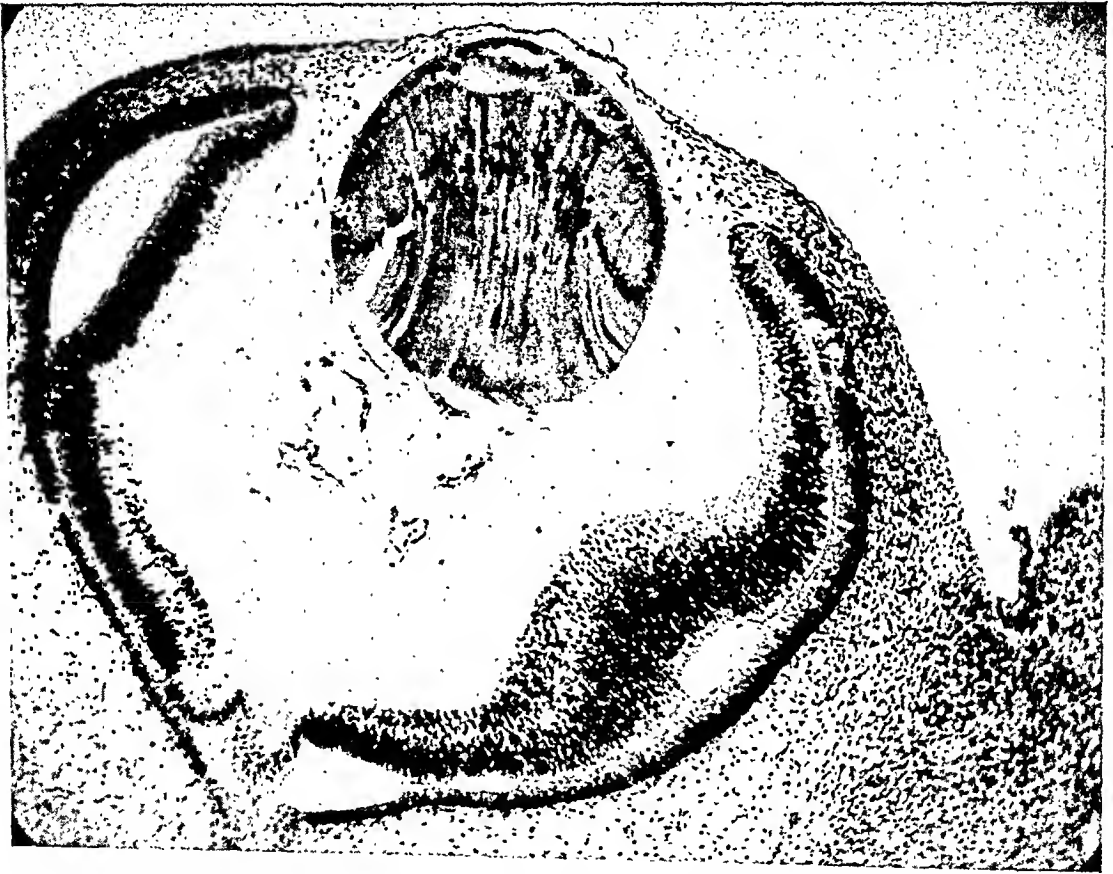


Fig. 21 (Cordes). Section of eye of 7- to 8-week-old embryo with history of rubella during the fifth week of pregnancy, showing retardation in development of lens. (Cordes and Barber. *Archives of Ophthalmology*, 1946, volume 36, August, page 135.)

cardiac defects (Gregg's series, 43 percent⁶³ and in Prendergast's series, 40 percent).⁶⁵ There is intolerance to atropine together with an inability to dilate the pupil. These babies are prone to pneumonia and may run a temperature of 105° to 106°F. A fairly high percentage show mental deficiency and microcephaly.

Two main types of cataract are observed. In the first type, there is a pearly-white central opacity with a smaller,

pigment changes in the retina. This has also been observed by Prendergast,⁶⁵ Terry,⁶⁶ and others.

In addition to cataracts, nystagmus, strabismus, corneal opacities, microphthalmus, and glaucoma have also been observed.⁶⁷

Surgical results in these cases have been only fair, one of the problems being an inability of dilatation of the pupil. In microphthalmic eyes the results have been poor.

Not without interest is the microscopic examination of the eye of a 7- to 8-week-old embryo with a history of rubella during the fifth week of pregnancy, as reported by Cordes and Barber.⁶⁸ This lens (fig. 21) showed definite retardation of development and differentiation while the posterior segment was normal. Terry,⁶⁶ in comparing the specimen with those in the Minot Embryological Collection at Harvard, stated that the lens showed the differentiation and size of a 17-mm. embryo, while the differentiation and over all size corresponded to the 19-mm. stage. Ida Mann⁶⁹ substantiated the retardation of the development of the lens. Cordes and Barber⁶⁸ offer, as a possible theory, the limitation of the development of the cataract to the first three months of pregnancy. Needham⁷⁰ has pointed out that the ultrafiltrable viruses can pass through the placenta into the amniotic fluid in man. Erickson⁷¹ mentions the fact that embryonic tissues are particularly susceptible to virus infection. During the first three months Descemet's and Bowman's membranes have not formed to protect the lens vesicle; thus, the toxic agent in the amniotic fluid is able to act fairly directly on the lens during this time. The growth of these barriers after the third month may explain the absence of initial lens changes after that time. Swan^{71-a} reported a 2½-month-old fetus with a history of rubella in the second month. Examination revealed unilateral cataract with lack of closure of the fetal fissure.

PERSISTENCE OF TUNICA VASCULOSA LENTIS

Retrolental fibroplasia (Terry); Persistence of tunica vasculosa lentis; persistence and hyperplasia of the primary vitreous (Reese and Payne)—these and many other terms all apply to an abnormality which, while strictly speaking is not a cataract, is so closely associated with the

lens that it warrants our consideration. The condition has been reported many times in the past as a unilateral lesion found at the time of birth in full-term infants. Gifford and Latta,⁷² in 1923, stated that cases of extensive persistence of the tunica vasculosa lentis were "not very rare." As a result of Terry's work,⁷³⁻⁷⁷ the condition has been called to our attention as an entity consisting of a bilateral lesion of premature infants. The increase of frequency is probably the result of the decrease of infant mortality during the last decade.

EMBRYOLOGY OF THE VITREOUS

To understand the condition, some knowledge of the embryology of the vitreous is necessary. At the 4.5-mm. stage, mesoderm begins to appear in the space between the lens plate and the optic vesicle. This mesoderm starts from the primary vitreous. By the 10-mm. stage the primary vitreous is composed of mesoderm derived from the hyaloid artery and from the mesoderm that enters the cup through the space between the anterior rim of the cup and the lens, together with ectoderm which is composed of fibrils from the lens and the inner wall of the optic cups. At the 13-mm. stage, the hyaline capsule surrounding the lens is completely formed so that the lens no longer contributes to the development of the vitreous. The capsula perilenticularis fibrosa is now formed by condensation of the fibrils adherent to the lens and derived from the lental part of the primary vitreous. During this period the hyaloid artery begins to send branches through the capsula perilenticularis fibrosa to form the tunica vasculosa lentis. This completes the development of the primary vitreous, consisting of ectoderm derived from the lens and retina and of mesodermal vasoformative tissue which has formed the hyaloid artery, the posterior

and lateral portions of the tunica vasculosa lentis. With the development of the secondary vitreous from the retina, the primary vitreous persists as a funnel-shaped area with its wide end at the posterior surface of the lens. The condensation line between the primary and secondary vitreous forms the "wall" of Cloquet's canal.

At the 60-mm. stage (11 weeks) the vessels begin to regress and by 8½ months all vessels except the main trunk have atrophied completely. Toward the end of fetal life the mesodermal part of the vitreous disappears and the permanent vitreous is exclusively ectodermal in origin.

CLINICAL COURSE AND APPEARANCE

The condition, present in 12 percent of all premature babies weighing three pounds or less, makes its appearance 4 to 6 months after birth as a gray-white membrane behind the lens. It may cover the entire lens surface or only part of it (fig. 22). Blood vessels of varying size and number are usually visible. The membrane is densest in the central area and



Fig. 22 (Cordes). Clinical appearance of retrolental fibroplasia.

in some cases thins out to such a point at the periphery that the fundus is visible. Terry⁷⁷ and Reese and Payne⁷⁸ report that very long, narrow ciliary processes which go to the edge of the membrane or

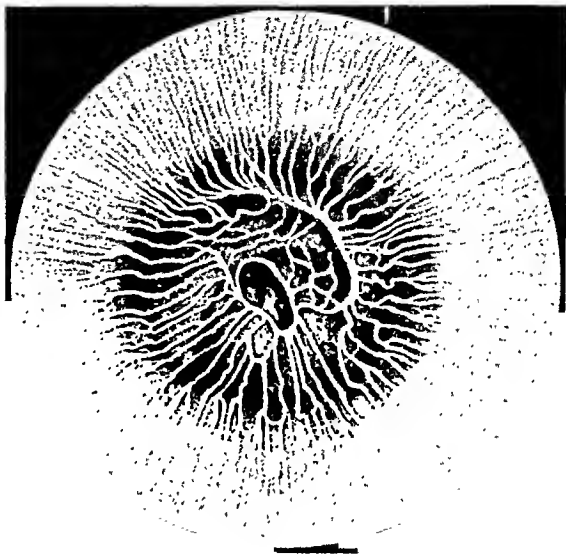


Fig. 23 (Cordes). Pupillary membrane rests (persistence of remnants of anterior part of tunica vasculosa lentis) associated with a case of retrolental fibroplasia.

are free can be seen around the equator of the lens. The condition is almost always bilateral. In one case personally seen, there was a persistent pupillary membrane consisting of the ghost vessels of the anterior part of the (fig. 23) tunica vasculosa lentis. These cases have a tendency to develop cataracts; and glaucoma is also a common finding.

Histologically, the posterior surface of the lens is observed to be covered by a dense fibrous tissue. Frequently, one sees clinically that the ciliary processes are elongated and attached to the connective tissue. This was also noted by Gifford and Latta.⁷² In some cases the central hyaloid artery, in the form of a cord of thread, is seen to extend to the posterior surface of the mass. Microscopically the tissue shows embryonic connective tissue and persistent fetal fibrillar vitreous; the

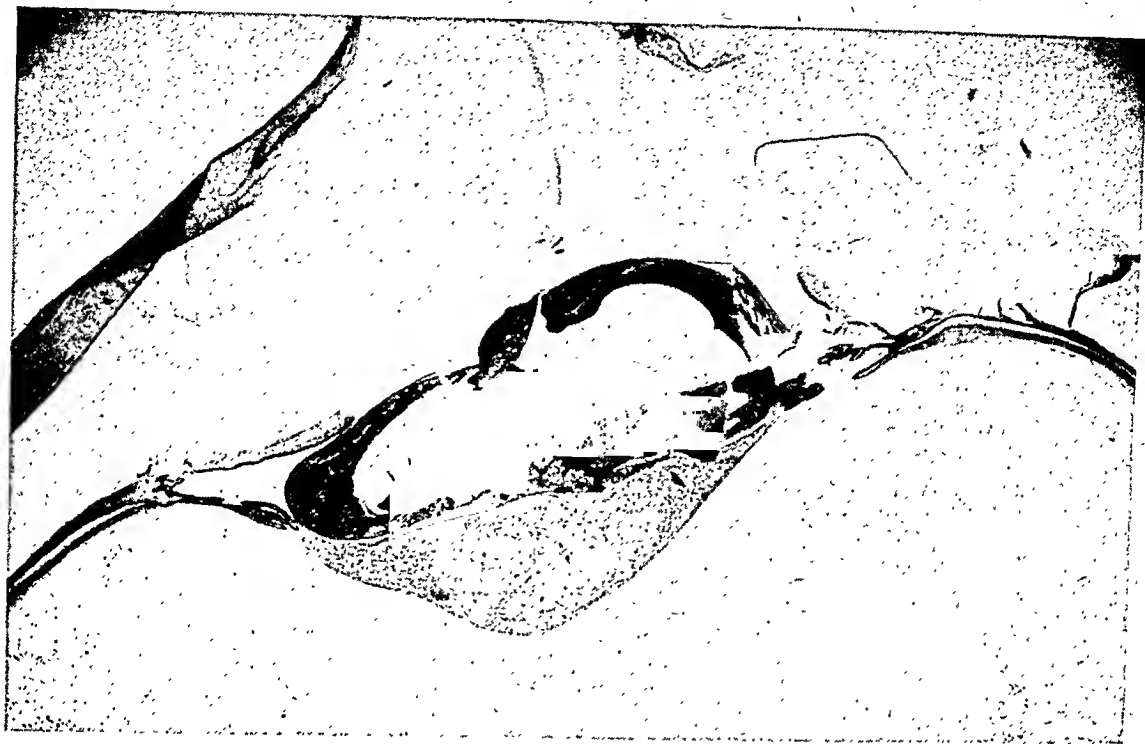


Fig. 24 (Cordes). Section through lens with retrolental fibroplasia (Dr. T. L. Terry).

fibrous tissue being rather rich in blood vessels (fig. 24).

Detachment of the retina is a fairly common occurrence in these cases. Reese and Payne⁷⁸ felt that the formation of the secondary vitreous plays a role in this condition. If the fibrous strands of the primary vitreous remain adherent to the inner surface of the retina then, when the secondary vitreous forms, the retina may be detached. All degrees of this process may be seen and in some of the cases the entire retina was detached and adherent to the retrolental mass.

Terry⁷⁶ feels that the condition is primarily a persistence of the tunica vasculosa lentis with hypertrophy. Reese and Payne,⁷⁸ on the other hand, look upon the condition as being a persistence in part or in toto of the primary vitreous with or without hyperplasia. They class the above lesion as one of four types of clinical manifestation of the condition. Haden⁷⁹ would seem to support this contention when he says that "toward the end of

fetal life very little of the primary vitreous remains. Sometimes, however, this primary vitreous fails to absorb and the mesodermal part develops into fibrous connective tissue, and a firm triangular, opaque mass is formed behind the lens." He further states⁸⁰ that the size, position, and style of the lesion is influenced by the fetal age at which the normal recession of the primary vitreous ceased.

In the differential diagnosis only two conditions deserve serious consideration; retinoblastoma and pseudoglioma. The nine cases on which Reese and Payne⁷⁸ did X-ray studies were all negative for calcium. Transillumination is good in these cases. The most important diagnostic points include first an opaque mass behind the lens that has an anterior concavity; and, secondly, long ciliary processes that can be seen around the edge of the lens. In addition, the history of most cases shows a premature birth. In most instances the lesion is bilateral.

Surgery and radiation have both been

employed in these cases but the results have been very unsatisfactory.

ENCEPHALO-OPHTHALMIC DYSPLASIA

Krause⁸¹ recently presented 18 cases under the title of congenital encephalo-ophthalmic dysplasia. The ocular disease was similar to, or identical with, retrolental fibroplasia of Terry or the persistence of the primary vitreous of Reese and Payne. This dysplasia was more commonly found in premature infants and in infants from a multiple birth. The common neurologic signs were mental retardation, microcephalus, and hydrocephalus. Clinically, the ocular disease rarely occurred without neurologic signs of involvement of the brain when the child was examined after the age of four years.

The ocular signs were loss of vision, ptosis, endophthalmos, microphthalmos, strabismus, retinal detachment, retrolental masses, retinal atrophy and gliosis, retinal dysplasia, coloboma of the choroid and optic nerve, recurrent hemorrhages in the retina and vitreous, secondary glaucoma, and cataract.

Reese⁸² in the discussion of Krause's paper felt it was the same condition described by Terry, and by Payne and himself. Terry called the lesion retrolental fibroplasia and concluded it was an acquired manifestation. Reese and Payne designated the lesion as persistence and hyperplasia of the primary vitreous. Krause believes the lesion represents a faulty development of the neuroectoderm in that portion where it forms the retina as well as the brain. Reese further stated that he felt the incidence of mental retardation was no higher than in the series of cataract associated with rubella and did not believe that Krause's findings justified the assumption that mental retardation is a usual accompaniment of the ocular lesion. Future studies will probably clarify the picture.

COMMENTS

From the foregoing, it is apparent that there is a wide variety of congenital cataracts.

It is well known that certain types have a hereditary tendency. Franceschetti⁸³ has listed the following as types with an hereditary tendency: congenital total cataract, lamellar cataract, embryonal nuclear cataract, coralliform cataract, spear cataract, floriform cataract, anterior axial embryonal cataract, anterior and posterior polar cataract, axial fusiform cataract, stellate cataract, and disc-shaped cataract.

Intrauterine trauma may at times produce lens changes as seen in the reduplication cataract.

As Ida Mann has pointed out,⁸⁴ we know experimentally that toxic substances administered to the mother during pregnancy may cause lens changes. It is known that interference with calcium metabolism and parathyroid secretion will produce the same opacities as will avitaminosis.

Recent work that has been done on rubella cataract has shown that infection in the mother is capable of producing cataracts. The section through the eye of a seven-weeks embryo with a history of rubella in the mother during the fifth week of pregnancy would seem to bear out the contention that the damage is done at the time of the infection.

In addition to the changes in the lens substance itself, there may be abnormalities of the vascular capsule, which is mesodermal, and which may cause such changes as retrolental fibroplasia, persistence, and hyperplasia of the primary vitreous. This is often associated with changes in the lens itself.

In conclusion, as Ida Mann⁸² points out, it must be remembered that the lens is transparent in its normal development and, therefore, all congenital lens opacities are pure aberrations and not arrests.

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THE TREATMENT OF LEWISITE AND OTHER ARSENICAL VESICANT LESIONS OF THE EYES OF RABBITS WITH BRITISH ANTI-LEWISITE (BAL)*

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At the beginning of the war, in 1939, work on the mode of action of and possible antidotes for the vesicants likely to be used in chemical warfare was initiated by an extramural research team (supported by the Chemical Defence Research Department of the Ministry of Supply) in Oxford under the direction of Prof. R. A. Peters. Peters, Stocken, and Thompson (1945) have described the preparation of the new compound 2:3 dimercaptopropanol (BAL) and its action as an antidote to the arsenical vesicants, and the reader is referred to this paper for details. The present paper describes experiments undertaken by the authors to determine the effect of BAL on lesions produced by Lewisite and other arsenical vesicants on the eye of the rabbit. The work was begun in 1941 at the laboratories of the Imperial Cancer Research Fund and was completed at Oxford. It was supported throughout by the Chemical Defence Research Department of the Ministry of Supply.

The action of BAL in averting, aborting, or reversing the destructive effect of Lewisite burns of the eye is so striking and can be so well-observed in the rabbit that it is worthy of recording in detail. No similar therapeutic effect on a destructive lesion of the eye is known, and the pathologic principle involved is a new one. Arsenicals are known to combine with thiol compounds, and Voegtlin

(1923) suggested that the toxicity of arsenic lay in its ability to combine with the $-SH$ groups of compounds, such as glutathione, which are essential in cell metabolism. Stocken and Thompson (1941) analyzed the compound of Lewisite and keratein, a protein containing many thiol groups, and they found that each Lewisite molecule combined with two thiol groups. This led them to prepare the dithiol compound 2:3 dimercaptopropanol (BAL) as a soluble penetrating "chaser" for Lewisite in the tissues. BAL combines with Lewisite readily to form a relatively stable compound and, therefore, competes with tissue proteins and other $-SH$ containing compounds for any Lewisite present. It penetrates the eye tissues with great rapidity, and the resultant compound of BAL and Lewisite is relatively harmless and capable of excretion through the kidneys. BAL reacts with Lewisite on the cell surface or within the cell itself and a most striking reversal of an intracellular destructive pathologic process can be observed. The eye is particularly suitable for demonstrating this new type of therapeutic reaction because of the ease with which changes in the eye can be observed over a long period of time by the aid of slitlamp microscopy.

METHODS

Rabbits were used in all experiments. They were mainly of mixed Dutch stock, chosen for eye color. They were housed in individual cages and fed a mash of bran, toppings, and sugar-beet pulp, together with fresh greens each day. Care was taken to use young, healthy animals as it was necessary to watch their eyes

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over a long period. A total of 150 eyes was used.

The experiments may be divided into five essential groups:

1. Effect of BAL itself on the normal eye.

2. Effect of Lewisite alone on the normal eye.

3. Effect of BAL on eyes injured by Lewisite.

4. Effect of BAL on eyes injured by other arsenicals.

5. Effect of BAL on eyes injured by a mixture of Lewisite and dichloro-diethylsulphide (mustard gas).

RESULTS

1. EFFECT OF BAL ITSELF ON THE NORMAL EYE

The effects of solutions of BAL of various strengths can be expressed briefly in tabular form, as they vary roughly with the concentration (table 1).

TABLE 1
EFFECT OF BAL ITSELF ON THE NORMAL EYE

Strength of Solution (BAL in Thiodiglycol,	Method of Application	Time (After Application)	Changes Observed
1 percent	One drop in eye	5-15 min.	Very slight contraction of pupil; no other change
	Continuous eye bath for 15 min.	5-15 min.	Pupil contracted; conjunctiva congested; epithelium damaged; recovered in a few hours
5 percent	One drop in eye	5-15 min.	Slight contraction of pupil; no other change
	Continuous eye bath for 15 min.	5-15 min.	Contraction of pupil; damage to epithelium, ?to substantia propria; flushing of iris; complete recovery
10 percent	Continuous eye bath for 15 min.	1-24 hr.	Contraction of pupil; corneal haze; chemosis; iritis
		4 days	Deep corneal vascularization
		12 days	Retrogression of vessels
		15 days	BAL dots* visible
20 percent	Continuous eye bath for 15 min.	1-24 hr.	Severe reaction with corneal haze, chemosis, and iritis
		4 days	Vascularization
		4-30 days	Acutely inflamed
		3 months	Healed with irregular vascular scar
25 percent	Single drop in eye	Immediate	Surface corneal opacity and contracted pupil
		24 hr.	Slight iritis and corneal edema
		10 days	Eye clear
		15 days	BAL dots*
30 percent	Single drop in eye		Similar to 25% solution
Undiluted BAL	Single drop in eye		Similar to 25% solution but may leave slight permanent nebula

* BAL dots are described in detail on page 423.

BAL dots. The appearance referred to (Table 1) as "BAL dots" was first visible on the 15th day after treatment of the eye with 10- to 30-percent solutions of BAL. It consisted of a series of opaque white and glistening dots visible with the slit-lamp in the area of maximum previous disturbance of the substantia propria; namely, the center of the cornea. These dots were evenly distributed under the epithelium within the superficial third of the substantia propria, and were visible by internal illumination (sclerotic scatter), as well as by direct (broad and narrow beam), and by retro-illumination. They were about the size of a corneal corpuscle and were of various shapes, ring forms, horseshoes, and short rods alternating with round dots. Their nature was investigated by cutting frozen tangential sections of the cornea, staining with hematoxylin and examining with an oil-immersion lens. They were then seen to be deposits of a hyaline, amorphous material in various sized granules lying within the cytoplasm of invading macrophages. Their exact nature is unknown and, so far, they have only been seen after application of BAL. They are not of any clinical importance. They remain stationary for a long time, but may change their position owing to the migration of the macrophages carrying them. In one eye, they were observed for 10 months; in another, for 14¾ months. They usually begin to thin out and to occupy a larger area in two to three weeks after they are first observed. If they have been first observed in a central clump, they will, by four or five months, have migrated peripherally so that they form a widely dispersed ring not quite half way to the limbus. In some cases, they spread out and disappear entirely within a year, in others some traces remain for at least 15 months.

It is thus evident that continuous ap-

plication for 15 minutes (as an eye bath) of a large amount of BAL in strengths varying from 5 percent to 20 percent is harmful, but that a single drop of a 30-percent solution can be used with safety. In subsequent therapeutic experiments, 10-percent and 20-percent solutions were generally used. The exact strength within these limits appears to be immaterial, although there is a slight balance in favor of 20 percent. Both stronger and weaker solutions than these are also effective in the presence of Lewisite. The action of pure BAL on an uncontaminated eye was also investigated and found to be similar to that of a 30-percent solution, but unlike this, it leaves a very slight permanent nebula.

2. EFFECT OF LEWISITE ALONE ON THE NORMAL EYE

In order to judge the therapeutic action of any substance, it is necessary to be able to produce a standard lesion, the course of which, if untreated, can be predicted with certainty. Any alteration in this course can then with safety be put down to the effect of the treatment given. We, therefore, attempted to produce standard lesions with Lewisite vapor and with liquid Lewisite.

It was found impossible to produce standard lesions with Lewisite vapor with the means at our disposal, so that liquid Lewisite was adopted in practically every case. Contamination by a 0.1 to 0.2 mg. droplet of Lewisite was used, since this produced complete destruction of the eye in every case. The exact site of application of the droplet of Lewisite made no difference to the end result; namely, destruction of the eye. The course of events leading to this could, however, be slightly modified by different techniques of application.

Thus, if the droplet were placed on the center of the cornea of an anesthetized

rabbit and the eye was carefully held open so that the lids did not come in contact with the cornea for 15 minutes, the eye was lost by shrinking after a stage of vascularization of the cornea (central control lesion).

If, on the other hand, the rabbit was

splash-and-blink lesion simulated more nearly that expected in war.

The course of events following these two types of lesion can be summarized and used for comparison with the treated series* (tables 2 and 3).

It is thus obvious that Lewisite leads

TABLE 2
CENTRAL CORNEAL CONTROL LESION WITH 0.1 TO 0.2 MG. LIQUID LEWISITE

Time	Lids and Conjunctiva	Cornea	Iris
Immediate		Central opacity	
2-5 min.	Lacrimation		Pupil strongly contracted
20 min.	Severe edema of lids and conjunctiva		
3 hr.	Extreme chemosis and hemorrhages	Corneal epithelium shed. Edema of substantia propria all over	
24 hr.	Chemosis and lid swelling much better. Large conjunctival hemorrhages	Staining all over with fluorescein	Severe exudative iritis
3 days	Very little discharge	Corneal epithelium healing	Severe iritis
6-8 days	Very little discharge	Epithelium healed. Uniform marginal vascularization of cornea. Vessels reach center of cornea	
3 weeks	Slight mucopurulent discharge	Separation of central slough or central perforation	Depigmentation of iris
6 weeks	Eye shrinking	Proliferation of limbal pigment	Anterior synechiae. Pupil blocked with cyclitic membrane

allowed to blink immediately after the application, so that the Lewisite was spread over the cornea, conjunctiva, and lids, destruction was more rapid and complete, the cornea perforating before any vascularization had taken place. This type of lesion simulated that to be expected from a droplet of Lewisite spray entering the eye in warfare or in a factory accident, and was known as the splash-and-blink control lesion. Both this and the central control lesion were used in testing the efficacy of BAL, since the central lesion allowed of more detailed observation of the course of the antidotal action; while the

immediately to gross edema and ends in complete destruction of every cell with which it comes in contact. It penetrates the tissues rapidly and exerts an almost immediate effect on the intraocular tissues as well as on the surface cells.

3. EFFECT OF BAL ON EYES INJURED BY LEWISITE

Studies of the course of such standard

*For a detailed description of the clinical pathology of Lewisite lesions of varying severity see Mann, Pirie, and Pullinger, "A Study of Lewisite Lesions of the Eyes of Rabbits." This JOURNAL, October, 1946.

Lewisite lesions treated with BAL at varying times after contamination revealed that the destructive effect could, under certain conditions, be entirely prevented.

This is demonstrated in Figures 1 to 12. Figures 1 to 6 show the stages of destruction in an untreated splash-and-blink lesion. Figure 7 shows one untreated (con-

eye in which treatment was delayed for 10 minutes. In this case, the eye became normal, but in similar cases seen in Figures 11 and 12 some permanent depigmentation of the iris remained, although the eyes were functionally perfect. These photographs show that we are dealing with a very remarkable reversal of a destructive lesion. The clinical changes must

TABLE 3
SPLASH-AND-BLINK CONTROL LESION WITH LIQUID LEWISITE

Time	Lids and Conjunctiva	Cornea	Iris
Immediate	Lids tightly closed. Lacrimation	Opacity wherever Lewisite in contact	
2-5 min.	Edema of 3rd lid beginning		Pupil strongly contracted
20 min.	Extreme edema of lids and conjunctiva		
3 hr.	Very marked swelling. Hemorrhages and dilated lymphatics all over conjunctiva		
24 hr.	Slightly less swelling	Cornea hazy and grossly edematous	Severe iritis
3 days	Eye closed with severe discharge	Severe edema	Severe iritis
10 days	Purulent discharge. Lids brawny	Cornea opaque and liquefying. No attempt at vascularization or repair	Iris not visible
3 weeks	Lids and conjunctiva contracting on to globe	Descemetocoele on the point of rupture	
4 weeks	Almost complete symblepharon to disorganized globe	Phthisis bulbi	

trol) eye and one apparently normal eye. This apparently normal eye had received the same dose of Lewisite, plus one drop of 20-percent BAL in thioglycol applied immediately after the Lewisite. This shows in a very striking manner the complete protection afforded. Figure 8 shows an intermediate stage of cure of a similar eye; the cornea was still slightly edematous in two days, but normal in three. Figure 9 shows an equally good result obtained by waiting five minutes before applying the BAL. Figure 10 shows an

be dealt with in some detail as the pathologic reaction involved is unusual.

Treatment of central corneal lesions. These lesions were used in the first group of therapeutic experiments to determine the effect on the cornea, iris, and ciliary body of treatment with BAL at varying times after contamination. Twenty-percent BAL in thioglycol was used in most cases, but the results were very similar for any concentration from 5 percent to 30 percent. The time series was worked out entirely with the 20-percent



Fig. 1 (Mann *et al.*). Eye of rabbit 30 minutes after contamination with liquid Lewisite. Note the extreme chemosis which largely obscures the cornea.

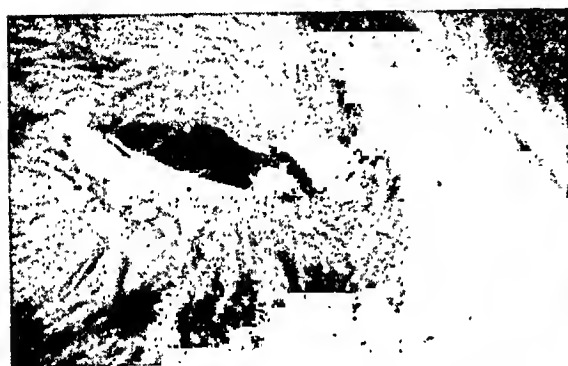


Fig. 2 (Mann *et al.*). Another eye (rabbit) two hours after contamination with liquid Lewisite. Note the swelling of the lids and the discharge. Chemotic conjunctiva overlaps the pupil at the inner canthus.

solution. The eyes were treated with BAL immediately, and at 1, 2, 3, 4, 5, 7, 9, 11, 13, 15, 20, 30, and 45 minutes after contamination.

The sequence of events in eyes treated immediately or 1, 2, 3 or 4 minutes after contamination was similar and as follows. (This should be compared with the sequence in the central control lesion in Table 2.) The site of application of the Lewisite became opaque immediately, and the pupil contracted strongly in two minutes, as in the control, showing that the Lewisite reached the iris and was not neutralized by the BAL entirely on the surface. After the BAL was dropped on, the central opacity became more gray and

diffuse, and the epithelium in the center shed off in about six minutes. At 10 minutes, slight chemosis began, and an occasional conjunctival hemorrhage was seen. This edema then rapidly subsided, never reaching extreme proportions. An hour after the application of BAL, it had disappeared, only a little conjunctival hyperemia remaining. The site of applica-



Fig. 3 (Mann *et al.*). Front view of rabbit with contamination of both eyes with liquid Lewisite 12 days previously. Note extreme swelling of lids and severe discharge.



Fig. 4 (Mann *et al.*). Left eye of rabbit shown in Figure 3.

tion of the Lewisite was then localized, white, and involved the whole thickness of the cornea. The surrounding cornea was grayish. The pupil was beginning to dilate again. The eye looked irritated, the central part of the cornea was denuded, and the lesion showed as a very clear-cut opacity. The striking chemosis and swelling of the substantia propria seen in the control were absent.



Fig. 5 (Mann *et al.*). Similar untreated Lewisite lesion in another rabbit on the 12th day.



Fig. 6 (Mann *et al.*). End result of untreated Lewisite lesion. The eye has perforated, and the lids have contracted down on it. Only a small discharging palpebral aperture is visible. 30 days after contamination.

In 24 hours, there was slight mucopurulent discharge, but the eyes were open, and the animal seemed to have little or no discomfort. The central part of the



Fig. 7 (Mann *et al.*). Front view of rabbit which had received a destructive dose of liquid Lewisite in both eyes 30 days previously. The right eye was untreated, the left received immediate treatment with a drop of 20-percent BAL in thiodiglycol. The right eye has perforated; the left is normal.

cornea stained with fluorescein and was hazy, but the limbus was normal. There was disturbance but not destruction of the



Fig. 8 (Mann *et al.*). Left eye of rabbit, seen in Figure 7, two days after Lewisite contamination and immediate treatment with 20-percent BAL. Note corneal edema and slight haze and roughening. There is no iritis. The eye became perfectly normal.

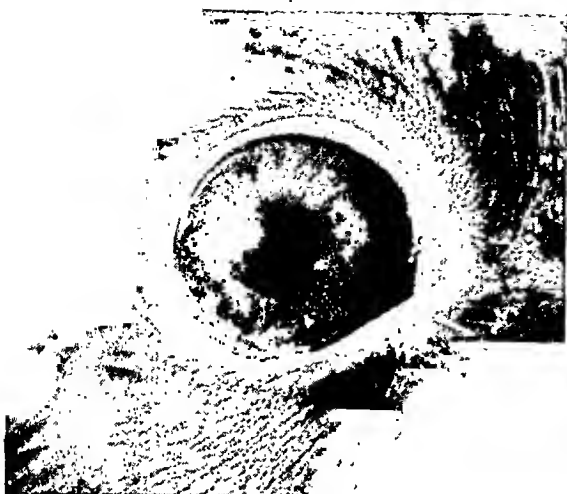


Fig. 9 (Mann *et al.*). Eye of a rabbit contaminated with Lewisite 26 days previously and treated after five minutes with BAL. The eye is normal.

endothelium in the central part. No trace of iritis or intraocular response of any kind was present.

In two days, the cornea was clearer, and only a small central area stained. This was healed by the fourth day, when the eye was open, bright, and normal, except for the small, central lesion which showed as a yellowish, slightly depressed area. It resembled an ulcer, but the epithelium was intact over it. On this day, the invasion by polymorphs and macrophages described by Pullinger and Mann (1943) as a stage in the process of avascular healing of the cornea could be observed with the slitlamp. It was greater by the seventh day, when the cells could be seen surrounding and invading the central localized opacity. The whole structure of the cornea in this region, including the collagen fibrils themselves, appeared to be altered and destroyed. The barrage of invading cells gradually extended into and beneath the lesion. Long, new, silky fibrils appeared, extending into it from the margins and gradually orientating themselves in the direction of the corneal lamellae, reconstituting them. This process took some time, slowly continuing

for about three weeks, during which time the eye was clear, bright, and practically normal, except for biomicroscopic changes in the central area.

By about the 25th day, the new tissue in the repaired area had pushed out a small, central, subepithelial bleb of corneal debris. This gradually seemed to liquefy until it appeared as a minute vesicle which then became absorbed without rupturing. It took almost three months to disappear to slitlamp examination but, clinically, the eye appeared normal throughout. This slow casting off and repairing of a small portion of the corneal substance was interesting to watch and seemed to indicate that, at the point of maximum concentration of the Lewisite, a minute area of irreversible destruction occurred, no matter how rapidly the BAL was applied. The end result was, however, always repair, although a very faint difference in texture of the central fibrils of the substantia propria could be detected with the slitlamp. In a few eyes, the area of repair remained slightly thinner than the rest of the cornea and appeared as a



Fig. 10 (Mann *et al.*). Eye of a rabbit contaminated with liquid Lewisite 20 days previously and treated after 10 minutes with BAL. The eye is normal.

minute facet, but this often became filled and flattened out by hyperplasia of the epithelium overlying it.

If the application of BAL was delayed for five minutes, the changes observed were more severe, and the process of repair took longer, although the end result was equally good. The immediate course of events was similar to that described for 1-, 2-, 3-, and 4-minute intervals, with the exception that the mucopurulent discharge continued for three days, and the eye appeared very tender to touch until the third day. On the fourth day, the epithelium was healed, and a pigment slide was present (Mann, 1944). Edema of the substantia propria extended to the limbus all round, and the limbal vessels were engorged. They began to invade the cornea on the fifth day, as in the untreated lesion. It appears likely that the signal for corneal vascularization is always extension of edema of the substantia propria to the limbus. No vessels were ever seen invading through normal substantia propria from a normal limbus.



Fig. 11 (Mann *et al.*). Eye of a rabbit contaminated with liquid Lewisite 18 days previously and treated after 10 minutes with BAL. The result is not quite so good as that seen in Figure 10. There is still slight corneal edema and a patch of depigmentation of the iris can be seen below.



Fig. 12 (Mann *et al.*). Eye of a rabbit contaminated with liquid Lewisite 26 days previously and treated after 10 minutes with BAL. The result is good, the cornea being clear, but there is an area of depigmentation of the iris in the lower part.

Instead of extending exuberantly to the center, as in the untreated control, these vessels began to retrogress and the edema to clear on the 12th day. It was then evident from the presence of faint opacities in the aqueous that there had been a mild iritis. No synechiae were formed and no depigmentation occurred. The vessels all disappeared rapidly, and the center of the lesion healed with the formation and absorption of the small bleb described above. The end result was as good as if the BAL had been applied immediately, but the course of the healing included early, but rapidly reversed, vascularization and a very mild iritis. Similar results were obtained after delays in application of BAL for 7, 9, 11, 13, and 15 minutes, the vascularization after each longer delay in treatment becoming more severe and taking longer to retrogress. In a few cases, "BAL dots" were seen, but these were rare when BAL was used after Lewisite.

If, however, BAL was not applied for 20 to 25 minutes after Lewisite, some of the changes were irreversible, and healing occurred with the formation of vascular corneal scars, produced by the entry of fibroblasts as well as the polymorphs and macrophages. The iritis also was more

severe, and areas of depigmentation were left on the iris. The course of events in such eyes treated after 15 or 25 minutes is summarized in Table 4.

It will be seen that, in the eye described in Table 4, the record is almost the same as for the untreated eye (table 2) for the first 24 hours. A difference from the con-

It will be seen that, if BAL is applied 15 or even 25 minutes after Lewisite, there is the possibility of retaining a functional eye, although the initial period of severe damage gets longer. The time at which reversal of the change can be definitely recognized is, with these long time intervals, about 12 days, during which time

TABLE 4
COURSE OF A CENTRAL CORNEAL LEWISITE LESION TREATED WITH BAL AFTER 15 MINUTES

Time	Lids and Conjunctiva	Cornea	Iris
(Application of Lewisite)			
Immediate		Central opacity	
2-5 min.	Lacrimation		Pupil strongly contracted
15 min. (Application of BAL)			
3 hr.	Severe edema of lids and conjunctiva but not so severe as control	Corneal epithelium shed. Edema of substantia propria all over	Faint aqueous flare
24 hr.	Chemosis and lid swelling better. Subconjunctival hemorrhages	Staining nearly all over with fluorescein	Aqueous flare only
3 days	Practically no discharge	Epithelium healing	Aqueous flare only
6 days	Practically no discharge	Epithelium healed. Marginal vascularization of cornea	
7-12 days	No swelling or discharge	Central opacity. Margin clearing and vessels retrogressing	Depigmentation of part of iris. Aqueous clear
3 weeks	Normal	Small central nebula and bleb only. Vessels all empty and barely detectable	No iritis

trol is shown by the fact that only a mild iritis occurred at 24 hours and that the marginal vascularization, which began as in the control, retrogressed between the 7th and 12th days and finally disappeared. The treated eye at three weeks was normal, except for slight depigmentation of the iris; whereas, the control eye was vascularized to the center of the cornea and about to perforate.

the treated eye appears almost as severely damaged as the control.

If treatment is delayed for 30 minutes, the vascularization is more severe and the resulting scar larger. However, even after this long delay, the ciliary body and the rest of the eye are not seriously involved.

If treatment is delayed for 45 minutes, the course is exactly similar to that of an

untreated eye. The eye shrinks, the lens becomes opaque, the iris and ciliary body are disorganized, and the fundus partially depigmented. Treatment must, therefore, be given in the first half-hour and preferably in the first five minutes.

Treatment of splash-and-blink lesions. A somewhat similar series of results was obtained when the Lewisite was applied by the splash-and-blink technique. Since this method produces a much more severe lesion than does the central application,

minor changes could be detected.

If, however, the time interval was lengthened, the results were not quite so good as in the series of central lesions. This was probably due to damage to the limbus, which by producing local edema permits vascularization. The results are shown in Table 6.

The demonstration afforded by the foregoing experiments of the value of BAL led naturally to an investigation of alternative ways of using it. Experiment-

TABLE 5

COURSE OF CENTRAL CORNEAL LEWISITE LESION TREATED WITH BAL AFTER 25 MINUTES

Time	Lids and Conjunctiva	Cornea	Iris
(Application of Lewisite) (Application of BAL after 25 min.)			
Immediate to 13 days	Almost as control	Vascularized all round on 4th day like control	Severe, but not so severe as control
18 days	Very little discharge	Margin of cornea clearing and vessels less exuberant	Iris depigmented
27 days	Very little discharge	Most vessels gone but a few large ones enter dense central opacity	
6 weeks	No discharge	Central vascular scar with some degenerative change. Eye not blind	Permanent depigmentation

the course of healing was not expected to be so striking. It was, however, found that immediate application of BAL to such a lesion produced an even better result than with a central corneal lesion. This is explained by the fact that the Lewisite is instantly spread all over the eye by the lids and, therefore, does not penetrate anywhere so deeply before the BAL can reach it. There was no central area of destruction to be cast off and repaired. A small area of superficial destruction of the substantia propria was present, but this was quickly repaired. Clinically, the eye looked normal in two days and even with the slitlamp only

ally, it is easy to separate a rabbit's eyelids and insert a drop of BAL. Under war conditions, however, a man might have difficulty in overcoming the intense lid spasm produced by Lewisite either in administering first aid to another person, or in attempting to treat himself.

The question of method, therefore, seemed important and, as described, experiments were done using drops of 2-percent, 10-percent, 20-percent, and 30-percent BAL in thiodiglycol. The results for 10 percent and 20 percent were the same. It was then decided to try the effect of merely rubbing the solution on to the outside of the lids, without forcing

the eye open. The rabbit's lids were shaved, and the liquid was massaged into them with a glass rod. It was found that, if the liquid was applied to the skin of the lids, carefully avoiding the lid margin, no protection was afforded at all, and the eye lesion ran its destructive course. If, however, the liquid came in contact with the lid margin, a sufficient quantity seeped into the eye to act on the Lewisite rapidly and to avert destruction of the eye. It also relaxed the lid spasm and made it easy to insert more BAL into

plied to the lid margin up to 10 minutes after contamination, the results were excellent and were good after 15 minutes' delay. This strength was, therefore, used.

Since a solution of BAL might be difficult to carry about and to manipulate, experiments were tried incorporating the BAL in various ointment bases which were known to be nonirritating to a normal eye. It was found that the results of massaging 20-percent BAL ointment into the margins of the closed lids gave, on the whole, good results, although, in a

TABLE 6
APPLICATION OF BAL TO A SPLASH-AND-BLINK LEWISITE* LESION

Time	Result
Application of BAL	
Immediate	Very good indeed
5 minute-interval	Very good, but vascularization of cornea and slight depigmentation of iris
10 minute interval	Good result with clear cornea and depigmented iris
15 minute interval	Good result with lightly vascularized peripheral scar slow in healing
20 to 25 minute interval	Result more problematic. Some healed with vascular scars after iritis; some eyes were useless

* If slightly less than the destructive dose of Lewisite was used, the results were excellent up to 25 minutes.

the eye. Massage of BAL on to the lid margin, therefore, seemed the method of choice for man.

It was found that, if a 10-percent solution was massaged in, the amount of BAL which actually entered the eye was not always sufficient to reverse the Lewisite action. Application of BAL up to five minutes after contamination of the eye with Lewisite gave excellent results, but application between five and ten minutes after contamination with Lewisite was not so successful. Two out of 10 eyes perforated and were lost, and the rest healed with vascular scars, a worse result than would have been obtained if 10-percent BAL had been dropped into the eye.

If, however, 20-percent BAL was ap-

plied to the lid margin up to 10 minutes after contamination, the results were excellent and were good after 15 minutes' delay. This strength was, therefore, used.

Twenty experiments were done giving the results found in Table 7. It is obvious that good results can be obtained by massaging BAL ointment into the margins of the closed lids, but these results are not so good as those given by opening the eye and dropping a 20-percent solution directly on to the cornea. If this is done, no eye is completely destroyed until the time interval is more than 30 minutes.

4. EFFECT OF BAL ON EYES INJURED BY OTHER ARSENICALS

BAL was used in a short series of experiments as an antidote to methyl- and ethyldichlorarsine. The effect of methyl-

and ethyldichlorarsine on the eye is similar to that of Lewisite, itself, given in a comparable dose. The eye is rendered useless both when the liquids are applied to the center of the cornea, or by the splash-and-blink method.

The effect is not quite so violent as that of Lewisite. Only one out of five control eyes ended in perforation of the cornea; the others were blinded by shrinking of the whole eyeball or by the formation of dense vascular scars and gross destructive lesions of the intra-

On the whole, the results were slightly better than in the Lewisite series.

5. EFFECT OF BAL ON EYES INJURED BY A MIXTURE OF LEWISITE AND DICHLORODIETHYL SULPHIDE (MUSTARD GAS)

It had been suggested that use in war of a mixture of equal parts of Lewisite and mustard gas was a possibility. From an offensive point of view, it was difficult to see what would have been gained by mixing a rapidly destructive and almost instantly detectable chemical-war-

TABLE 7
RESULTS OF MASSAGING BAL OINTMENT INTO MARGINS OF CLOSED LIDS

Time Interval	No. of Eyes	Result		
		Very Good	Fair	Eye Lost
		(Clear cornea or only a few vessels)	(Vascular scar)	
Up to 5 min.	12	8	2	2
10 min.	8	3	2	3

ocular structures. No difference in action could be detected between the methyl and ethyl compounds.

Treatment was carried out by dropping a 20-percent solution of BAL in thiodiglycol into the eye immediately and after intervals of 5, 10, 15, 20, and 25 minutes. Twelve eyes were used (two contaminated with methyl- and 10 with ethyldichlorarsine). In all but three, the application was by the splash-and-blink technique. The results obtained were similar to those obtained with Lewisite, with the exception that "BAL dots" were more readily detected in the healed eyes than they were in the Lewisite series. Immediate application saved the eye completely. Application of BAL up to 25 minutes after contamination also saved the eye in every case. In several eyes, however, small vascular scars and patches of depigmentation of the iris remained.

fare agent with one whose chief advantages were slowness of action and absence of immediate warning effects. It was, however, decided to investigate the action of BAL against such a mixture in the eye. We know already that BAL exercises no curative action on the lesion caused by mustard gas alone. It does not make it worse, and any action it may have is a purely mechanical one and not specific in any way.

We did not know either the effect on the eye of mixing Lewisite and liquid mustard gas, nor whether BAL would exercise any effect on the mixture. Eight experiments only were done. The results were very clear cut and in accordance with what we know of the action of Lewisite and of mustard gas on the eye and of the effect of BAL. They can be briefly described.

If a 50:50 mixture of Lewisite and

mustard gas is applied to a rabbit's eye in the manner described for Lewisite (central corneal lesion and splash-and-blink lesion), the course of events is exactly that which would have been expected from Lewisite alone. The eye is destroyed in the same time and by the same process. Since in the case of lesions with mustard gas alone, we knew that the course of a central corneal lesion is not the same as that of one involving the limbus (Mann and Pullinger 1940, 1942, 1942, and Mann 1942), we also tried the effect of an untreated limbal lesion made with the mustard-gas-Lewisite mixture. Its course was again that of a pure Lewisite lesion.

We, therefore, tried the effect of immediate treatment with 20-percent BAL of a central-corneal lesion produced with 50:50 Lewisite-mustard gas. The eye recovered without iritis or vascularization and also without extrusion of corneal debris. The result was better than if Lewisite alone had been used. This is explicable by the fact that, in a standard droplet of the mixture, there was less Lewisite than was used in the first group of experiments described above (in which a very small portion of the corneal substance was destroyed before the BAL could act). The central nebula resembled the "silky" result of a central, non-vascularizing mustard-gas lesion and disappeared entirely.

If the same dose of the mixture was applied as a droplet astride the limbus and treated immediately with BAL, the result was very interesting. The prophylactic effect on the Lewisite moiety was complete. No Lewisite iritis, vascularization, or separation of debris occurred. Healing, however, was delayed as the lesion ran the typical course of a small, untreated limbal mustard-gas lesion. On the fourth day, a secondary edema involved most of the cornea and

small blood vessels, preceded by intra-corneal hemorrhages and showing pointed ends, invaded the limbus on either side of the lesion and elsewhere where the edema reached the limbus. These vessels were deep and of a shape and arrangement known to be typical of vascularization following mustard-gas burns. They remained mildly active for about eight weeks, and the eye finally healed with only a few traces of empty vessels. This shows a very neat "sorting out" and neutralization of the Lewisite molecules by the BAL; the mustard-gas action being unaffected.

Treatment by Bal was also given to splash-and-blink lesions with the Lewisite-mustard-gas mixture. The immediate application prevented all Lewisite effect, but slight edema from the mustard gas was visible at the lower limbus, and a few deep vessels invaded here on the sixth day. These disappeared in four weeks.

If treatment of such a splash-and-blink lesion was delayed for 15 minutes (or even 5 minutes), a good deal of vascularization occurred. The vessels were numerous and arranged in straight rows like those typical of Lewisite, but they were larger than these usually are and accompanied by a few intracorneal hemorrhages which we have come to look on as very suggestive of mustard-gas burns. The eyes cleared in about six weeks, leaving faint, vascular nebulae. There appeared to be a mixed effect here, the Lewisite change having begun before the BAL could act.

It is obvious that BAL should be used in treatment of a mixed contamination and as speedily as possible.

SUMMARY AND CONCLUSIONS

1. The action of 2:3 dimercaptopropanol (BAL) was studied on the intact rabbit's eye, on eyes contaminated with droplets of Lewisite, methyl- and ethyl

dichlorarsine and with a mixture of Lewisite and liquid mustard gas.

2. A single application of BAL in solutions of 1 percent to 30 percent in thiodiglycol to the intact rabbit's eye was without permanent ill effects. Application of pure BAL was slightly more irritating but the eyes recovered from this also. BAL was, therefore, a possible therapeutic substance for eye lesions.

3. Application of BAL within five minutes to an eye contaminated with a destructive dose of Lewisite was successful in preventing the action of the Lewisite. Applications delayed for varying times up to 25 minutes also saved the function of the eye, although partial permanent damage remained.

4. A 20-percent solution of BAL in thiodiglycol gave the best results when dropped into the eye. Surprisingly good results were, however, obtained with 20-percent ointments rubbed onto the closed lids along the line of the palpebral aperture.

5. BAL is equally effective as an antidote to methyl- and ethyldichlorarsine.

6. BAL is effective against the Lewisite moiety of a Lewisite: mustard-gas mixture, but the lesion due to the mustard-gas portion progresses uninfluenced.

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TESTS FOR HETEROPHORIA*

RELIABILITY OF TESTS, COMPARISONS BETWEEN TESTS, AND EFFECT OF CHANGING TESTING CONDITIONS

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Muscle balance is a subject in which the student of ocular functions almost invariably takes an early interest. The discovery of several points soon lessens this interest. Among these is the clinical observation that relatively large amounts of heterophoria may be present in an individual and yet that individual may be perfectly comfortable. Another of these is the statement found in the literature on ocular muscle balance that heterophoria varies not only from day to day but also from moment to moment in the same individual.¹ These two observations lead many students to the conclusion that it matters little what test of heterophoria is used or how carefully it is performed since the results will probably be inaccurate and of dubious significance.

Nevertheless, in any thorough survey of ocular functions, heterophoria cannot be neglected. Heterophoria is a deviation of the eyes from the position of fixation when fusion is prevented.² Measurements of heterophoria, therefore, reveal how much of a motor task fusion has to perform in bringing images upon corresponding retinal points. Certainly the individual with little or no heterophoria, all other

things being equal, will secure binocular single vision with much less effort than the individual with marked heterophoria. The average clinician is not particularly concerned with whether his patient has 4 prism diopters of exophoria or 6 prism diopters of exophoria, unless that exophoria is indicative of symptom-producing strain. Neither is he particularly concerned when a patient tested on one day shows 4 prism diopters of exophoria and when tested again, on a subsequent visit, shows 6 prism diopters of exophoria.

When it becomes necessary, however, to select large numbers of men in accordance with certain arbitrary standards of heterophoria, as in the selection of pilots for the Army Air Forces, the amount of the heterophoria and the reproducibility of the determinations become important. To illustrate the point, the exophoria limit for pilots for Class 1 in the Army Air Forces has been chosen as 5 prism diopters. An applicant for pilot training who has more than this amount will receive no further consideration. If, after attaining his coveted "wings," a pilot is found to manifest more than the limit of 5 prism diopters of exophoria at any time, he will be "grounded," perhaps for a time, perhaps permanently.

At least three sources of error may be recognized in the routine performance of tests now available. First, an individual may have inconstant amounts of manifest heterophoria.³ This variation may be due either to a variation in the amount of

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manifest heterophoria of the subject or to inaccuracies in the testing technique. The two sources of variation are inseparable and may be considered together as individual variation. In evaluating tests for heterophoria, those which show little individual variation in comparison with the total range in the sample of tested subjects will be preferred over those which show large individual variation. This is the same as saying that the test must have high reproducibility or *reliability*.

Second, examiners may not all perform the test for heterophoria in exactly the same way. Particularly if a large number of individuals must be examined at many different places in short periods of time, as in time of war, the multitude of examiners will not have equal degrees of competence in the administration of the test.

Third, different tests or conditions of testing may not be equally effective in converting similar amounts of the total heterophoria into manifest heterophoria which can be measured. Despite the number of tests available, a comparison of the tests by modern statistical methods has seldom been made. Cridland's work⁴ stands almost alone in this field.

The present study is directed toward answering some of the questions about the available tests for heterophoria. First, we shall estimate the reliability of the screen Maddox-rod test, and in the same experiment look for systematic differences between examiners which may contribute to unreliability. The screen Maddox-rod test was chosen because this test, described by Dolman,² has been in use throughout the Army Air Forces. Second, we shall make comparisons between several available tests, including among these the screen and parallax test which is universally regarded as being the most accurate one. These comparisons were made

at two different testing distances, 20 feet for distance fixation and 13 inches for near fixation. Third, we shall attempt to estimate the effect of varying the testing conditions upon the Maddox-rod test. The alternative conditions studied were a light vs. a dark room, the use of screening vs. not screening, the placing of the Maddox rod over the dominant vs. the nondominant eye, and the use of a red vs. a white Maddox rod.

DESCRIPTION OF TESTS

All of the tests used in this study are familiar to students of ocular muscle balance. With one exception, only brief descriptions will be given.

Screen and parallax test. A 1-cm. light was used at 20 feet and an ophthalmoscope with the head removed was used at 13 inches. A cover was shifted from one eye to the other, square prisms being changed behind the cover until any objective movement of the eye and any subjective movement of the light had ceased.

von Graefe's prism diplopia test. At a distance of 20 feet, a 20/100 size Snellen letter "E" was employed as a test object, while at 13 inches a similar letter "E" 2 mm. in height was used. The test object was adequately illuminated at both distances and an insuperable diplopia was created with a vertically placed 5-diopter prism before one eye. The examinee was asked to adjust the two images (by means of a Risley rotary prism) so that they were in the same vertical line.

Screen Maddox-rod test. Because the study to be reported concerns the technique of the screen Maddox-rod test, the test is described in full. At 20 feet, the test object was a muscle light, 1 cm. in diameter; at 13 inches, it was an ophthalmoscope with the head removed. All lights in the immediate vicinity of the muscle light were turned out but the room was not entirely darkened. With the Maddox

rod placed before the nondominant eye, a cover was also held before the same eye and removed regularly for a period of 1 second at about 3-second intervals, meanwhile allowing the dominant eye to maintain fixation constantly. This very brief uncovering or "flashing" of the nondominant eye had for its purpose a further weakening of the fusion control. For the measurement of heterophoria, a Risley rotary prism is rotated into position (also before the nondominant eye) and set between 3 and 4 diopters "off" of the zero position; this forces the examinee to make some adjustment even though orthophoria is present. The examinee grasps the handle of the rotary prism and, while the muscle light is being "flashed" before the eye behind the Maddox rod, he is instructed to adjust the line so that it bisects the light.

Maddox-rod test. This test is the same as the screen Maddox-rod test just described except that screening is omitted.

Maddox-wing test. Used at 13 inches, this is a well-known test and needs no particular elaboration other than to mention that an arrow is seen by the right eye only, while calibrated lateral and vertical scales are seen by the left eye only.

+ *Thorington test.* This is also a well-known test and employs a Maddox rod. Linear scales, calibrated in units of 2 prism diopters, are drawn on the face of a card which is mounted on the head of a flashlight, a pin hole being located at the exact center of the card which is also the point of intersection of the lateral and vertical scales. The flashlight bulb is visible only through the hole in the card's center. The testing distance is 13 inches. A Maddox rod is placed before one of the examinee's eyes and he is asked to state at what point the line of light (as seen through the Maddox rod) intersects the calibrated scales.

RELIABILITY OF THE SCREEN

MADDOX-ROD TEST

The problem of reliability of the screen Maddox-rod test was approached from the point of view that if the test were not reproducible under relatively ideal conditions, then it was not likely to be reproducible under the routine testing conditions necessary for the physical examination for flying used in the Army Air Forces. The experiment was therefore planned to yield a maximum reliability of the screen Maddox-rod test.

Plan of study. Two examiners, who had watched each other work and whose testing techniques were as nearly identical as possible, performed the tests. Both examiners tested each subject on each of two different days. No subject remained seated in the examination room for consecutive tests by both examiners; instead, one examiner examined the entire group of subjects for the day before turning them over to the second examiner. The test-retest interval varied from 1 to 5 days. Both lateral and vertical heterophoria measurements were made at each testing period. All subjects were tested at the 20-foot distance; none wore glasses and there was no correction of refractive error. The screen Maddox-rod test technique as outlined in the previous section was utilized throughout.

Limitations of the study. All subjects were aviation cadets who, theoretically, had a visual acuity of at least 20/20 in each eye, a normal amount of accommodation and convergence, and heterophoria of not more than 1 prism diopter of hyperphoria, 10 prism diopters of esophoria, or 5 prism diopters of exophoria. The population available for study therefore represented a special selection from the general population with the consequence that the heterophoria readings extend over a limited portion of the entire range.

Another limitation arose from the fre-

quency distribution of heterophoria which was not normal in form. A distribution for 131 subjects tails out to the right (the statistic of skewness, $g_1 = 1.38$, is 6.5 times its own standard error; the statistic of kurtosis, $g_2 = 4.37$, is 10.4 times its own standard error). To test the normality of distributions still further, data were borrowed from Cridland⁴ for the purpose. In one of these (the red-green test) there is significant skewness to the right and in the other (the Maddox-rod test) there is

limits of experimental error for all subjects. (The interaction $S \times E$ is not significant.) Similar statements may be made with respect to the records of vertical heterophoria. Under the relatively ideal conditions of this study, therefore, it was found possible to achieve a high agreement between examiners, and the results are similar to those which may be expected if a single examiner performed all the testing.

The measurements of both lateral and

TABLE 1

AVERAGE HETEROPHORIAS OBTAINED BY TWO EXAMINERS USING THE SCREEN MADDOX-ROD TEST, ANALYSIS OF VARIANCE APPLIED TO MEAN DIFFERENCES, AND RELIABILITY COEFFICIENTS

Examiner	Lateral, n=50			Vertical, n=49			
	1st Test	2nd Test	Average	1st Test	2nd Test	Average	
A	+1.02	+1.18	+1.10	-0.06	-0.11	-0.09	
B	+1.39	+1.22	+1.30	-0.10	-0.08	-0.09	
			+1.20			-0.09	
Variation Due to	df.	Mean Square	F	df.	Mean Square	F	F. _{.01}
Subjects, S	49	11.27	21.03	48	0.43	12.56	1.73
Examiner, E	1	2.10	3.92	1	0.001	—	6.90
SXE	49	0.24	—	48	0.04	1.12	1.73
Error	100	0.54		98	0.03		
Standard error of a single determination		0.73			0.18		
Coefficient of reliability		+0.95			+0.92		

Note: For lateral heterophoria, + means esophoria, - means exophoria; for vertical heterophoria, + means right hyperphoria, - means left hyperphoria.

significant skewness to the left. The inconsistency of these findings suggests no general way of transforming the heterophoria scale to normality at this time.

Results. The results of testing 50 subjects for lateral heterophoria and 49 subjects for vertical heterophoria are summarized in Table 1. Examiner A recorded an average of 1.10 prism diopters of esophoria and Examiner B, an average of 1.30. This difference is not significant ($F = 3.92$ where $F_{.01} = 6.90$) and consequently there is no evidence of general disagreement between examiners. Furthermore the examiners agreed within the

vertical heterophoria are highly reliable when made with the screen Maddox-rod test. The coefficients of reliability are +0.95 and +0.92 for the two types of measurements, respectively. These coefficients are based upon the internal consistency of the four records taken on each subject and are computed by a method suggested by Hoyt.⁶ In practical terms, these coefficients mean that any careful examiner can make heterophoria measurements with sufficient accuracy to discriminate between subjects. A notion of the absolute accuracy with which heterophoria may be measured may be obtained

from the standard errors of single determinations. For lateral heterophoria, the standard error is 0.73 which means, approximately, that a lateral heterophoria measurement may be in error by as much as 1.5 prism diopters (2×0.73). For vertical heterophoria, the error may be as much as 0.4 prism diopters (2×0.18).

COMPARISONS BETWEEN TESTS

Many factors, both anatomic and innervational, determine the amount of heterophoria elicited by any one test at

test for use in testing large numbers of men, as in time of war, it is necessary to have an accurate test that can be administered in a minimum of time. Of all heterophoria tests, the screen and parallax test eliminates a greater number of innervational factors than any other test and thus allows the closest possible approach to the position of absolute rest. The screen and parallax test is considered somewhat tedious by the novice, however, and requires a fair degree of skill for proper performance. Hence it appears de-

TABLE 2
AVERAGE LATERAL HETEROPHORIAS, STANDARD DEVIATIONS, AND COEFFICIENTS
OF CORRELATION BETWEEN TESTS FOR HETEROPHORIA

	20 Feet			13 Inches				
	Screen and parallax	Screen Maddox rod	von Graefe prism diplopia	Screen and parallax	Screen Maddox rod	von Graefe prism diplopia	Maddox wing	Thorington
Mean \bar{x}	+0.5	+1.4	+1.8	-8.2	-5.9	-3.0	-3.0	-2.8
Stan. Dev. s_x	2.2	2.8	1.9	7.4	5.8	5.2	3.4	4.3
Correlation coefficients, r								
Screen Maddox rod	+0.81	—	—	+0.48	—	—	—	—
von Graefe prism diplopia	+0.84	+0.85	—	+0.72	+0.41	—	—	—
Maddox wing				+0.68	+0.29	+0.76	—	—
Thorington				+0.77	+0.35	+0.88	+0.70	—

Note: For lateral heterophoria, + means esophoria, — means exophoria. To be significant, any r should exceed $r_{0.01} = +0.36$.

any one time. If it were possible to eliminate entirely all these innervational factors, then the eyes would assume the position variously referred to as the position of rest, the fusion-free position, or the fusion-frustrated position. Bielschowsky¹ has pointed out that any determination of the absolute position of rest is practically impossible because the totality of nervous influences cannot be eliminated in any way.

Various tests of heterophoria yield varying results in the same individual because varying numbers of innervational factors are eliminated by each of the different tests. In choosing a heterophoria

sirable to know how other tests of heterophoria compare with the screen and parallax test.

Plan of Study. Fifty aviation cadets were tested by a single examiner for lateral heterophoria on eight tests, three with a testing distance of 20 feet, and five with a testing distance of 13 inches. At 20 feet, the screen and parallax test, von Graefe's prism diplopia test, and the screen Maddox-rod test were used. At 13 inches, the screen and parallax test, von Graefe's prism diplopia test, the Maddox-wing test, the Thorington test, and the screen Maddox-rod test were used.

Results. It is obvious from the sum-

mary of results in Table 2 that the tests which use a testing distance of 20 feet do not agree precisely with each other. Yet the level of agreement is reasonably high considering the diverse nature of the tests. All three tests yielded about the same average heterophoria and about the same spread around the averages. The coefficients of correlation are equal within the limits of random sampling. There is no clear choice among these three tests based upon statistical evidence alone. From the standpoint of ease of performance and time required, the screen Maddox-rod test may be preferred by some to either von Graefe's prism diplopia test or the screen and parallax test.

When the heterophoria tests which use a testing distance of 13 inches are considered, the screen Maddox-rod test is apparently no longer the satisfactory test that it was at 20 feet (table 2).

The screen and parallax test, as expected, uncovered the highest average exophoria, 8.2 prism diopters. The screen Maddox-rod test uncovered an average of 5.9 prism diopters of exophoria. The other three tests were about equivalent. They uncovered an average of 3.0 prism diopters of exophoria in the sample of 50 subjects. The variabilities about the averages, as judged by the standard deviations, are quite different. Consequently, on the basis of the means and standard deviations alone, the five tests at 13 inches cannot be regarded as equivalent. The coefficients of correlation reveal that four of the tests would rank the subjects in approximately the same order of degree of heterophoria. The exception is the screen Maddox-rod test which is not sufficiently correlated with the other four tests to be used as a replacement for any one of those tests. The coefficient of correlation of the Thorington test with the screen and parallax test is 0.77, while that of von Graefe's prism diplopia test is 0.72, and that of the

Maddox-wing test is 0.68. The screen Maddox-rod test trails all the others with a correlation coefficient of only 0.48.

Although the screen Maddox-rod test is apparently in a class by itself at a testing distance of 13 inches, this may in part be due to the fact that the sample is preselected on the basis of the screen Maddox-rod test. Removal of this restriction might yield a higher correlation with the screen and parallax test. However, in another sample of similar subjects tested in similar fashion, the screen Maddox-rod test agreed well with the screen and parallax test. This sample is discussed in a later section.

It must be realized that the screen Maddox-rod test at 13 inches, although apparently in a class by itself, may possibly be the best instead of the worst test of heterophoria and that it may be measuring something that the other tests are not. It is unfortunate that the present state of our knowledge is insufficient to allow a decision to be made.

CONDITIONS OF THE MADDOX-ROD TEST

The screen Maddox-rod test has been found to have a satisfactory self-consistency, at least under ideal conditions, and a satisfactory agreement with the screen and parallax test when the testing distance is 20 feet. These facts, plus its relative ease of administration, make it a desirable test for use for routine measurements of heterophoria on large numbers of subjects, as in time of war.

The screen Maddox-rod test was chosen as the standard test for the Physical Examination for Flying (WD AGO FORM No. 64). Certain variations in the testing conditions appeared during the war, and their effect upon the heterophoria measurements was not known, at least not in quantitative terms. Among the departures from uniform conditions, the following alternatives were regarded as important

enough to merit special study: a light vs. a dark room, the use of screening vs. not screening, the placing of the rod over the dominant vs. the nondominant eye, and the use of a red vs. a white Maddox rod.

The effect of illumination in the testing room was investigated in a separate experiment. The other three alternatives were incorporated into a single experiment.

EFFECT OF ILLUMINATION

There are conflicting arguments in the literature on heterophoria about the

tions requiring visual efficiency which might reasonably be affected by heterophoria.⁴

METHODS

In an experiment designed to resolve this difference of opinion, lateral and vertical heterophoria was determined under two alternative conditions at a testing distance of 20 feet upon 60 subjects. All the subjects were aviation cadets and thus were a selected group. The two conditions of testing were:

1. *Dark.* The testing room was in com-

TABLE 3
COMPARISON OF HETEROPHORIAS DETERMINED IN LIGHT AND IN DARK

	Lateral		Vertical	
	Light	Dark	Light	Dark
Mean, \bar{x}	+1.17 2.20	+1.02 2.37	-0.03 0.24	-0.02 0.25
Correlation, r	+0.89		+0.90	
Mean difference	0.150		-0.008	
Standard error of mean difference	+0.137		+0.015	
Ratio, t^*	1.10		0.55	

$n = 60$ subjects.

* For the mean difference to be significant, t should exceed 2.66.

For lateral heterophoria, + means esophoria, - means exophoria; for vertical heterophoria, + means right hyperphoria, - means left hyperphoria.

amount of illumination required or permitted in the testing room. Those who prefer testing in darkness contend that, if only a spot of light is visible in an otherwise dark room, any planes of reference which would serve to fix accommodation will be lost in the darkness and therefore eliminated as variables. More heterophoria would be uncovered in this manner and hence the test made more accurate. The assumption behind this argument is, of course, that the test uncovering the most heterophoria is the best.

In contrast, those who prefer testing in an illuminated room maintain that the subject in darkness is in an abnormal situation in no way comparable to condi-

plete darkness except for a muscle light 1 cm. in diameter located 20 feet from the subject. The walls and ceiling of the room were painted black.

2. *Light.* The same room was used except that a 60-watt, frosted Mazda bulb was burning directly above the subject's head. Illumination measured 5 foot-candles at head-height directly beneath the bulb (9-foot ceiling) and 0.5 foot-candles at the end of the room (20 feet away) where the muscle light was located. In this illumination, all objects in the room could be seen fairly distinctly.

There was no appreciable lapse of time between tests, the light-room and dark-room determinations being made at the

same examination on each subject, although the order of the two tests was reversed in every other subject.

RESULTS

The results of the tests for heterophoria using the screen Maddox-rod test under the two conditions of illumination are summarized in Table 3. For this group of 60 subjects, the following assertions may be made:

1. *The average heterophorias, determined in light and in dark, are not sig-*

this experiment to support the claim that amounts of illumination up to that used in this study will significantly affect the measurement of heterophoria. Cridland⁴ reached a similar conclusion using the Maddox-rod test (without screening).

EFFECT OF SCREENING, EYE DOMINANCE, AND ROD COLOR

METHODS

One hundred subjects, all aviation cadets, were tested for heterophoria for

TABLE 4
AVERAGE HETEROPHORIAS AT 20 FEET AND AT 13 INCHES

	20 Feet			13 Inches		
	With Screening	Without Screening	Average	With Screening	Without Screening	Average
Dominant eye	(1)	(2)		(1)	(2)	
Red rod	+1.80	+1.49	+1.65	-4.97	-5.33	-5.15
	(3)	(4)		(3)	(4)	
White rod	+1.58	+1.11	+1.35	-4.44	-5.33	-4.89
Average	+1.69	+1.30	+1.50	-4.71	-5.33	-5.02
Nondominant eye	(5)	(6)		(5)	(6)	
Red rod	+1.89	+1.55	+1.72	-4.99	-5.04	-5.02
	(7)	(8)		(7)	(8)	
White rod	+1.70	+1.33	+1.52	-4.70	-4.99	-4.85
Average	+1.80	+1.44	+1.62	-4.85	-5.02	-4.92
Average						
Red rod	+1.85	+1.52	+1.68	-4.98	-5.19	-5.08
White rod	+1.64	+1.22	+1.43	-4.57	-5.16	-4.87
Average	+1.74	+1.37	+1.56	-4.78	-5.17	-4.98

n=100 subjects.

+ means esophoria.

- means exophoria.

nificantly different. This is true for both lateral and vertical heterophoria.

2. *The variability* about the average, measured in terms of the standard deviation, is essentially the same for the two conditions of illumination, for both lateral and vertical heterophoria.

3. *There is a high correlation* between the determinations of heterophoria in light and in dark for both lateral and vertical heterophoria.

There is no evidence, therefore, from

near and distance fixation in a refracting alley 20 feet in length whose walls were painted black. The room was illuminated as described in the previous section on Maddox-rod determinations in a "light" room. The muscle light used at the 20-foot distance was a spot of light 1 cm. in diameter. At the 13-inch distance, the light was an ophthalmoscope with the head removed. Each subject was seated comfortably in a chair and determination of the dominant eye made by asking the

subject to sight the muscle light across the room through a 1-cm. hole in a 10- by 10-inch board which was held at arms' length with both hands, both eyes being held open. Heterophoria measurements were first made by the method of screen and parallax using the testing distances of 20 feet and 13 inches and employing a Beren's, plastic prism bar. The calibrations on the bar had been checked and found to be correct at a previous time.

whereas, the average at 13 inches was about 5.0 prism diopters of exophoria (table 4). The variation about the averages of the determinations at 20 feet is quite unlike that of the determinations at 13 inches (table 5). These facts make it necessary to preserve a separation of the data collected at the two different distances, and to look for the effects of screening, the dominance of the eye, and the colors of the rod separately in the two

TABLE 5

STANDARD DEVIATIONS OF HETEROPHORIA DISTRIBUTIONS AT 20 FEET AND AT 13 INCHES

	20 Feet		13 Inches	
	With Screening	Without Screening	With Screening	Without Screening
Dominant eye	(1)	(2)	(1)	(2)
Red rod	2.65	2.67	5.29	5.52
	(3)	(4)	(3)	(4)
White rod	2.67	2.40	5.24	5.53
Nondominant eye	(5)	(6)	(5)	(6)
Red rod	2.98	3.07	5.66	6.07
	(7)	(8)	(7)	(8)
White rod	2.90	2.38	5.75	5.78

$n = 100$ subjects.

Test for homogeneity of variances:

$X^2 = 12.15$

$X^2 = 2.79$

$P = 0.10 - 0.05$

$P = 0.95 - 0.90$

After this measurement, a phorometer was accurately adjusted before the subject and testing was begun with the Maddox rod. Both red and white Maddox rods were used in testing before each eye separately, with and without the use of screening. This was done at testing distances of both 20 feet and 13 inches. All possible combinations of the four variables just mentioned were tested on each subject. This necessitated 16 separate measurements on each subject, the measurements being taken in random order.

The heterophorias determined at 20 feet are different from the heterophorias determined at 13 inches in several respects. In the present series of determinations upon 100 subjects, the average at 20 feet was about 1.5 prism diopters of esophoria;

bodies of data. Further, the variabilities in the eight distributions of heterophoria for the eight experimental conditions with a testing distance of 20 feet were found to be homogeneous when tested by the method of Bartlett.⁷ It appears, therefore, that whatever change is introduced into the heterophoria determination at 20 feet by a change in the experimental conditions, the change affects the average only and does not affect the distribution about the average. A similar assertion may be made for the changes introduced in the 13-inch test.

Screening vs. not screening at 20 feet. When a Maddox rod is used in heterophoria determinations, it is placed before one of the examinee's eyes. The eye behind the rod perceives a spot of light as a

line of light while the other eye sees the spot as it really is. This distortion of dissimilarity of images disrupts fusion to a certain extent, thus allowing the eye behind the rod to deviate toward its dissociated position. The extent of this deviation may be measured exactly by the utilization of prisms. Dissimilarity between the two images of the same object as perceived by the two eyes does *not* completely abolish the fusion impulse.^{7, 8}

The cover test, that is, alternate occlusion of each eye separately, breaks up fusion as completely as is possible without actually occluding both eyes simultaneously. The covering or screening principle is the basis of the screen and parallax test.

The addition of intermittent screening of the eye behind the Maddox rod in testing heterophoria allows this test to approximate more closely the screen and parallax test, since the same basic principle is common to both. Omission of screening from the screen Maddox-rod test would seem to alter the test.

When the screen was used at 20 feet, the average heterophoria was found to be 1.74 prism diopters of esophoria; when the screen was not used, the average was 1.37 prism diopters of esophoria. The difference of 0.37 prism diopters is statistically significant, and indicates that on the average the use of the screen adds about 0.3 or 0.4 prism diopters to the heterophoria reading.

This difference due to screening appears to exist regardless of the color of the Maddox rod or of the dominance of the eye. When a red rod was used, the average was 1.85 prism diopters of esophoria with screening and 1.52 prism diopters of esophoria without screening, giving a difference of 0.33 prism diopters. When a white rod was used, the averages were 1.64 and 1.22 prism diopters of esophoria with and without screening, respectively,

giving a difference of 0.42 prism diopters. With the rod before the dominant eye, the difference was 0.39 prism diopters (1.69 with screening minus 1.30 without screening), and before the nondominant eye, the difference was 0.36 prism diopters (1.80 minus 1.44). Table 4 contains a summary of the means for all combinations of the experimental conditions.

Screening vs. not screening at 13 inches. At 13 inches, effects comparable to those at 20 feet were found. With screening, the average heterophoria was 4.78 prism diopters of exophoria; whereas, without screening, the average was 5.17 prism diopters of exophoria, or an increase of 0.39 prism diopters. This difference is statistically significant, and is the same in magnitude and direction as the shift observed at 20 feet when screening was omitted. (An increase in exophoria is the same in direction as a decrease in esophoria.)

The effect of screening is present with the rod before either the dominant or the nondominant eye, and with both colors of rods. When the rod is before the dominant eye, the change is 0.62 prism diopters; that is, from 4.71 with screening to 5.33 without screening; and when the rod is before the nondominant eye, the change is 0.17 prism diopters; that is, from 4.85 to 5.02. With the red and white rods, the changes are 0.21 and 0.59 prism diopters respectively (table 4).

It is necessary to specify, therefore, that screening be done or omitted throughout the routine testing of heterophoria, whether at 20 feet or at 13 inches.

Dominant vs. nondominant eye at 20 feet. The question of whether the Maddox rod should be placed before the dominant or the nondominant eye during heterophoria testing is one of long standing. Dolman⁵ suggested placing the rod before the nondominant eye on the basis of observations of 100 cases, 81 percent of

which revealed different heterophoria measurements when each eye was tested separately. He observed that 66 percent exhibited more heterophoria when the rod was placed before the nondominant eye; 7 percent had more with the rod before the dominant eye; and 17 percent gave identical figures regardless of which eye was behind the Maddox rod. Dolman made conflicting interpretations of these observations when he said "... it is evident . . . that the unequal degrees of deviation depend upon the fact that the role of fixation is given to each eye in turn. The stimulus received by the retina of the eye fixing the text object (fixation reflex) determines the direction of both visual axes when the other eye is screened."

When Dolman's data are subjected to statistical analysis, it becomes obvious that his conclusions, drawn on analysis of percentages only, are erroneous. Actually there is in Dolman's data no significant difference between results of testing with the Maddox rod before first the dominant eye and then the nondominant eye. Clinical testing for heterophoria varies in this respect. Placement of the Maddox rod before the dominant eye is recommended by many clinicians on the assumption that occlusion of the habitually fixing eye more completely disrupts fusion. Others routinely place the Maddox rod before the right eye, which means that the Maddox rod is before the dominant eye about 75 percent of the time.

No significant difference was discovered between heterophoria measures with the Maddox rod placed separately before either the dominant or the nondominant eye under any condition tested in this study. The average with the rod before the dominant eye was 1.50 prism diopters of esophoria, and before the nondominant eye was 1.62 prism diopters of esophoria. This similarity exists with or

without screening, and with the red or with the white Maddox rod.

Dominant vs. nondominant eye at 13 inches. There was no significant difference between heterophoria measured with the Maddox rod placed separately before either the nondominant or the dominant eye at 13 inches. When the rod was before the dominant eye, the average was 5.02 prism diopters of exophoria, and when the rod was before the nondominant eye the average was 4.92 prism diopters of exophoria. This similarity in heterophoria reading is present with or without screening, and with a red or with a white rod.

It does not appear necessary to designate whether the dominant or the nondominant eye shall be used in the routine testing for heterophoria, at 20 feet or at 13 inches. This conclusion is consistent with Dolman's⁵ data.

Red vs. white Maddox rod at 20 feet. The color of the Maddox rod used to measure heterophoria may be important in testing because the human eye is approximately 0.5 diopter hypermetropic for the color red.⁹ Thus the eye should accommodate 0.5 diopter more in clearly imaging a line seen through a red Maddox rod than one seen through a white Maddox rod. This increased accommodation should create an increased convergence tendency which may manifest itself as esophoria. Thus if a red rod is used instead of a white one, we may logically expect exophoria to decrease and esophoria to increase. A white rod should theoretically yield a more accurate measure for this reason. Another argument for the use of the white Maddox rod instead of the red one is that the white rod is usually far more optically accurate than the red by virtue of the production methods utilized for the two rods.⁵

In this study, changing from a red to a white rod was, on the average, equivalent to subtracting 0.25 prism diopters of

esophoria from the reading. With the red rod, the average reading was found to be 1.68 prism diopters of esophoria; with the white, it was 1.43 prism diopters of esophoria. The difference is statistically significant.

This difference due to color of the rod was found to exist when the rod was before either the dominant or the non-dominant eye. With the rod before the dominant eye, the change from a red to a white rod produced 0.30 prism diopters less of esophoria; with the rod before the nondominant eye, the change produced 0.20 prism diopters less of esophoria. Likewise, the difference introduced by the color of the rod persisted in the presence or absence of screening. With screening, the white rod gave 0.21 prism diopters less of esophoria than the red rod, without screening, the white rod gave 0.30 prism diopters less. The difference between the red and the white rod is a little less than the 0.50 prism diopters expected on theoretical grounds.

For routine determinations of lateral heterophoria, it appears to be important to specify the color of the rod which is to be used in the testing at 20 feet.

Red vs. white Maddox rod at 13 inches. Changing the color of the rod did not significantly change the heterophoria reading at 13 inches. With a red rod, the average was 5.08 prism diopters of exophoria, and with a white rod, 4.87 prism diopters of exophoria. This similarity was found both in the presence and absence of screening, and with either the rod before the dominant or the nondominant eye. For determinations of heterophoria at 13 inches, therefore, it does not appear to be necessary to designate the color of the Maddox rod.

The fact that the color of the Maddox rod makes a significant difference at a testing distance of 20 feet but none at 13 feet can be explained on logical grounds.

At 20 feet, the patient is using a minimum of accommodation and the increase of 0.5 diopter necessary to image clearly the red rod's line is sufficient to become manifest as an increase in esophoria. At 13 inches, however, a minimum of 3 diopters of accommodation is being exerted and the added 0.5 diopter necessitated by changing from a white to a red Maddox rod is not sufficient to become manifest as more esophoria.

CORRELATION OF MEASUREMENTS

Correlation between measurements of heterophoria at 20 feet. While an average increase of 0.37 prism diopters was introduced by the use of the screening, this amount of change did not occur exactly for each subject under each of the combinations of testing conditions. The high uniformity of the change, however, may be seen from product-moment coefficients of correlation in Table 6. The correlation coefficients between the screening and not screening measurements average about +0.90, which is equivalent to saying that knowledge of heterophoria determined without screening may be used to predict heterophoria with screening with a high degree of accuracy. Similar correlation coefficients for the red-rod versus the white-rod tests, and for the rod before the dominant eye versus the rod before the non-dominant eye likewise show high relationships for these testing conditions.

To facilitate transformation of heterophoria readings taken at 20 feet with screening into readings without screening, linear regression coefficients are included in Table 6. To illustrate the use of the regression coefficients, assume that a measurement of heterophoria was made on a single individual with a light at 20 feet and a red rod before the nondominant eye, using screening. Assume further that it is desired to transform this measurement into that expected if screening had not

been used. The regression of not screening on screening (b_{65} in table 6) is 0.98 for these conditions, which says that for each diopter change in heterophoria measured with screening, there is on the average 0.98 prism-diopter change in the same

The screen and parallax test using a light source at 20 feet from the subjects gave an average of 0.64 prism diopters of esophoria (table 7). This is about one diopter less than the average of the eight variations of the Maddox-rod tests. The meas-

FORMULA

$$\begin{array}{c} \text{Predicted} \\ \text{heterophoria} \\ \text{without} \\ \text{screening} \end{array} = \begin{array}{c} \text{Average} \\ \text{heterophoria} \\ \text{without} \\ \text{screening} \end{array} + \begin{array}{c} \text{Regression} \\ \text{of screening} \\ \text{on non-} \\ \text{screening} \end{array} \left[\begin{array}{c} \text{Observed} \\ \text{heterophoria} \\ \text{with} \\ \text{screening} \end{array} - \begin{array}{c} \text{Average} \\ \text{heterophoria} \\ \text{with} \\ \text{screening} \end{array} \right]$$

Taking the appropriate values for the conditions specified (red rod before nondominant eye), gives:
 $\text{Predicted} = 1.55 + 0.98 (\text{Observed} - 1.89)$

Assume that 4 prism diopters of esophoria were observed in a subject with screening. The predicted heterophoria for this subject without screening is 3.6 prism diopters of esophoria.

direction without screening. Substitution in the above formula will accomplish the desired transformation.

Correlation between measurements at 13 inches. The correlation coefficients for the intensity of the relationship between measurements at 13 inches are sufficiently high to enable accurate prediction from a measurement taken under one circumstance to a measurement taken under another (table 6).

Correlation of Maddox-rod tests with the screen and parallax tests at 20 feet.

urements of heterophoria by the eight variations of the Maddox-rod test correlate equally well with measurements made by the screen and parallax test. At first glance, there appear to be higher correlations between the screen and parallax test and all variations of the Maddox-rod test when the rod is before the nondominant eye than when the rod is before the dominant eye. The difference between the corresponding correlations was found to be nonsignificant (by z transformation). There is consequently no obvious advan-

TABLE 6

CORRELATION COEFFICIENTS AND REGRESSION COEFFICIENTS FOR MADDOX-ROD TEST

Variables		20 Feet			13 Inches		
i	j	Correlation r_{ij}	Regression b_{ij} b_{ji}		Correlation r_{ij}	Regression b_{ij} b_{ji}	
A. With screening <i>vs.</i> without screening							
1	2	0.88	0.87	0.89	0.87	0.83	0.91
3	4	0.90	1.00	0.81	0.89	0.84	0.94
5	6	0.95	0.92	0.98	0.84	0.78	0.90
7	8	0.88	1.07	0.72	0.83	0.83	0.83
B. Red rod <i>vs.</i> white rod							
1	3	0.93	0.92	0.94	0.88	0.89	0.87
2	4	0.93	1.04	0.84	0.89	0.89	0.89
5	7	0.93	0.96	0.90	0.91	0.90	0.92
6	8	0.91	1.17	0.71	0.92	0.97	0.88
C. Dominant eye <i>vs.</i> nondominant eye							
1	5	0.80	0.71	0.90	0.90	0.84	0.96
2	6	0.78	0.68	0.90	0.80	0.73	0.88
3	7	0.88	0.81	0.96	0.89	0.81	0.98
4	8	0.83	0.84	0.82	0.80	0.77	0.84

$n = 100$ subjects.

The numerals used to designate the variables may be identified on the table of means (table 4).

b_{ij} is the regression of i on j .

b_{ji} is the regression of j on i .

tage of testing with the nondominant eye. Further, there is no general advantage of the screen Maddox-rod test over the Maddox-rod test alone (without screen-

Correlation of the Maddox-rod tests with the screen and parallax test at 13 inches. With respect to correlations with the screen and parallax test there is no

TABLE 7

CORRELATION OF SCREEN AND PARALLAX TEST WITH EIGHT VARIATIONS OF THE MADDOX ROD

	20 Feet	13 Inches
Screen and Parallax test		
Mean \bar{x}	+0.64 Diopter (eso.)	-8.07 Diopter (exo.)
Stan. Dev. s_x	1.70	5.99
Correlation Coefficients of Screen and Parallax Test with Maddox Tests.		
D-R-S	+0.56	+0.60
D-R-O	+0.60	+0.59
D-W-S	+0.73	+0.64
D-W-O	+0.65	+0.60
N-R-S	+0.82	+0.77
N-R-O	+0.77	+0.70
N-W-S	+0.76	+0.73
N-W-O	+0.77	+0.79

$n=100$ subjects.

D=rod before dominant eye

N=rod before nondominant eye

R=red rod

W=white rod

S=with screening

O=without screening

TABLE 8

ANALYSIS OF VARIANCE FOR HETEROPHORIAS AT 20 FEET AND AT 13 INCHES; 100 SUBJECTS TESTED 16 TIMES; THAT IS, AT TWO DISTANCES, WITH AND WITHOUT SCREENING, WITH RED AND WHITE RODS, AND WITH ROD BEFORE THE DOMINANT AND THE NONDOMINANT EYES

Source	df.	20 Feet		13 Inches		F ₀₁
		Mean Square	F	Mean Square	F	
Screening (with-without) K	1	27.75	54.41	31.60	11.05	6.70
Lighting (red-white) M	1	12.75	25.00	9.46	3.31	6.70
Eyes (dom.-nondom.) O	1	3.00	5.88	1.53	—	6.70
Subjects, N	99	$s_n^2=50.98$	99.96	$s_n^2=215.40$	75.31	1.42
K \times M	1	0.45	—	7.41	2.59	6.70
K \times O	1	0.06	—	10.35	3.62	6.70
K \times N	99	1.55	3.04	9.63	3.37	1.42
M \times O	1	0.45	—	0.45	—	—
M \times N	99	0.92	1.80	6.10	2.13	1.42
O \times N	99	4.00	7.84	10.37	3.63	1.42
Remainder	397	$s_e^2=0.51$	—	$s_e^2=2.86$	—	—
All interactions	697	$s_e^2=1.21$	—	$s_e^2=5.36$	—	—
Estimate of reliability, based on s_n^2 and s_e^2 , r_{11}		$=0.976$	—	$=0.975$	—	—

ing) so far as the correlation with the screen and parallax test is concerned.

At this testing distance, the results in this experiment agree with those for a previous experiment summarized in Table 2, where the correlation between the screen Maddox-rod test and the screen and parallax test was found to be 0.81.

obvious choice among the variations of the Maddox-rod test at a testing distance of 13 inches (table 7). However, in this sample, the correlations are all higher than the correlation found in the previous experiment (table 2). No obvious explanation for this discrepancy has occurred to us.

NOTE ON STATISTICAL METHOD.

These two experiments, at near and distance fixation, are factorial in type with three factors being tested at each of two levels. When it was found that the variances of heterophoria at 20 feet constituted a homogeneous set which was definitely different from the variances at 13 inches, the data for the two distances were kept separate. This made it possible to use the method of analysis of variance to detect the main effects of screening, eye dominance, and rod color, as well as the interactions of these factors. The results of the statistical analysis are summarized in Table 8, in which evidence is contained for each of the assertions about significance or nonsignificance of the difference made in the preceding sections.

The design of this experiment also makes possible an estimate of reliability of the measurement of heterophoria using the methods of internal consistency proposed by Hoyt.⁶ For heterophoria measured with a testing distance of 20 feet, the reliability coefficient was 0.976, and with a distance of 13 inches the coefficient was 0.975.

✓ SUMMARY

✓ 1. The reproducibility or reliability of measurements of heterophoria when taken by two examiners using the screen Maddox-rod test was found in one sample of aviation cadets to be satisfactorily high. The coefficients of reliability were +0.95 for lateral heterophoria and +0.92 for vertical heterophoria at a testing distance of 20 feet. In another sample, after removal of systematic effects due to the use of screening and to changing the color of the rod, the Maddox-rod test both at 20 feet and at 13 inches had a reliability coefficient of +0.97 for lateral heterophoria.

✓ 2. There is no significant difference in results obtained by two different examiners in administering the screen Maddox-rod test.

3. Several tests for heterophoria were compared with the screen and parallax test, which is considered the most accurate test. At a testing distance of 20 feet, a high correlation was found with von Graefe's prism diplopia test and with the screen Maddox-rod test. At a testing distance of 13 inches, a high correlation was found with von Graefe's prism diplopia test, the Maddox-wing test, and the Thorington test. The correlation with the screen Maddox-rod test was somewhat lower in one experiment, but high in another.

4. The effect of varying the testing conditions upon the Maddox-rod test was determined. The amount of illumination had no significant effect. It makes no difference whether the Maddox rod is placed over the dominant or the nondominant eye. At a testing distance of 20 feet, a red Maddox rod uncovers more esophoria than does a white one, but there is no difference between the effect of the red and white rods at 13 inches. With screening, the Maddox-rod test uncovers more esophoria or less exophoria than without screening.

5. The Maddox-rod test for all possible combinations of four alternative testing conditions was found to be highly correlated with the screen and parallax test.

6. The following conclusions may be drawn from the results.

a. Heterophoria measurements may be performed with sufficient accuracy to discriminate between individuals.

b. The Maddox-rod test gives results sufficiently like those of the screen and parallax test to be used as a replacement for it for purpose of routine testing.

c. It is recommended that the Maddox-rod test be performed with a white rod, without screening, and without regard to placing the rod before the dominant or nondominant eye for purposes of routine testing. ✓
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ACUTE GLAUCOMA: A FOLLOW-UP STUDY*

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As part of an effort to emphasize the fallacy of fitting newer knowledge of glaucoma to an accepted classification, rather than fitting the classification to our newer views regarding glaucoma, I reviewed, in 1940, a series of 49 cases¹ of acute glaucoma. It was pointed out in that paper that an acute glaucomatous attack frequently starts without congestion and only after the vascular system of the eye no longer can tolerate the high tension and accumulation of metabolic products does congestion supervene. I concluded that the classification of acute glaucoma as congestive glaucoma is unjustifiable and suggested that the presence or absence of congestion be designated in an auxiliary diagnosis; for example, acute glaucoma—congestive phase, or acute glaucoma—non-congestive phase, as the case may be. A review of this same series of cases after a period of six years is presented, since it revealed further justification for the above conclusions, as well as rather interesting observations on

the course of acute glaucoma and the provocative tests for this condition. An addition to the therapeutic approach is suggested as a result of this study.

Since the case histories of the series were published in the original presentation, only those cases in which pertinent information has been added will be reviewed. In addition, a few cases not of this series are included in this paper to emphasize particular points under discussion.

Of the 49 patients in this series, four were instances of acute glaucoma due to lenticular intumescence. All of these were treated surgically and required no further follow-up from the viewpoint of this paper. Therefore, all of the following considerations will concern only the remaining 45 patients with "primary" acute glaucoma. Of these, 17 had had surgical treatment to both eyes at the time the original study was published. Four others could not be followed (cases 12, 19, 34, and 43). Thus, a total of 21 patients (46.6 percent) did not contribute to the follow-up study. Of the remaining 24 patients, 12 (cases 8, 10, 11, 17, 21, 29, 30, 31, 35, 36, 37, and 45) showed no significant

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change from the time of the original study, and 12 (26.6 percent of the total) showed some significant change during the six-year follow-up interval. The latter are here reviewed in detail. The case numbers are the same as in the original, published study.

CASE HISTORIES

Case 2. This 44-year-old woman had experienced blurring of vision with the left eye during and after seeing motion pictures for two years before coming to the Illinois Eye and Ear Infirmary (hereafter referred to simply as the Infirmary). Occasionally, the blurring was accompanied by ocular pain, nausea, and vomiting. There was never any redness of the eye. During the same period, reading had caused enough discomfort to cause her to avoid it. Two days after being refracted under homatropine cycloplegia at the Infirmary in 1940, she awoke during the night with a headache. The eyes were not red. The following morning, the patient was nauseated and vomited, but the eyes were still pale. The patient went to the Infirmary the same day, where the tension in the left eye was found to be 60 mm. Hg (Schiotz). Miotics were promptly effective in reducing the tension to normal. Provocative dilatation of the right eye with a 2-percent homatropine-hydrobromide solution was ineffective in raising the tension in three hours.

In spite of the continuous use of pilocarpine instillations once daily, this patient experienced an acute attack of glaucoma in the left eye after an emotional upset on April 1, 1944. Pain was severe for 12 hours. The eye was pale. An iridencleisis operation was performed to relieve this attack. The tension was controlled thereafter with the use of pilocarpine. A repeated provocative dilatation of the right pupil with homatropine-hydrobro-

mide (2 percent) solution was ineffective in raising the tension in two hours.

Case 6. This 56-year-old man became aware of pain and blurred vision in his right eye in January, 1939, while playing cards. The eye was not red until the following morning. No treatment was sought for two weeks. Four weeks after the onset of the attack, examination at the Infirmary revealed a stony-hard eye which responded only to surgical treatment. Provocative dilatation of the left eye with paredrine for three hours was ineffective in raising the tension. Both chambers were shallow.

On June 15, 1942, the tonometric readings were: R.E., 24 mm. Hg (Schiotz); L.E., 77 mm., in spite of the use of pilocarpine. Vision in the left eye had become blurred two weeks previously. An iridectomy was done on June 25, 1942. The tonometric readings remained normal until the patient left the state in November, 1944.

Case 9. This 62-year-old woman began to notice halos and occasional headaches whenever returning home from attending a motion picture theatre in November, 1938. The eyes were never red, and the symptoms were always relieved by cold applications. In August, 1939, while on a trip, the right eye became painful, and later red. An oculist whom she consulted referred to the condition in a letter as acute glaucoma. The use of miotics was successful in relieving the attack within four hours after beginning treatment. On returning from the trip, the patient was seen at the Infirmary. Tension in the right eye was 80 mm. Hg (Schiotz), but the eye was not red. Miotics promptly reduced the tension to normal. A similar blurring and pain involved the right eye on April 15, 1940. The increased tension was promptly reduced to normal with miotics. The eye was not red.

Provocative dilatation of the pupil of

the left eye with paredrine and homatropine solutions was ineffective in causing an acute glaucomatous attack. The pupil could not be dilated beyond 4.5 mm. in $3\frac{1}{4}$ hours.

In spite of the continuous use of pilocarpine, this patient experienced another acute attack in the right eye on July 30, 1945. The tension was: R.E., 84 mm. Hg (Schiotz); L.E., 22 mm. Tension in the right eye was reduced to 31 mm. by the next day but it returned to 54 mm. three days later. On August 6, 1945, an iridencleisis was performed on the right eye. This, together with the use of pilocarpine, controlled the tension.

A repeated provocative dilatation of the pupil of the left eye with a 2-percent homatropine-hydrobromide solution was ineffective in raising the tension in two hours.

Case 15. This 60-year-old woman noticed blurring and pain in her right eye, followed by headache and vomiting, on November 3, 1939, after weeping. Three days after the onset, the ocular hypertension was reduced to normal with miotics. The left eye was unaffected. Provocative dilatation of the pupil of the left eye, in 1940, caused an acute ocular hypertension which was relieved quickly with one drop of 0.25-percent eserine. The eyes remained normal on miotic therapy until March 5, 1941, when this patient appeared after having had pain, redness, and decreased vision in the left eye for three days. The tonometric readings were: R.E., 20 mm. Hg (Schiotz); L.E., 80 mm. The tension was reduced to normal rapidly with 2-percent pilocarpine-nitrate instillations. This patient was able to seek private medical care so further follow-up was not possible.

Case 16. This man, aged 69 years, in 1941, experienced his first attack of glaucoma one afternoon in 1938. He had pain and headache on the left side of the

head. This was successfully relieved by the application of heat. Five days later, shortly after awakening, another attack occurred. The eye was not red until later in the day. The pain and blurring of vision which were present at the onset continued less severely for five weeks before the patient was seen at the Infirmary. Miotics were ineffective, and a trephining operation was successfully done on the left eye on February 25, 1938. The right eye had a tension of 52 mm. Hg (Schiotz) on July 3, 1940. This was promptly normalized with miotics. Provocative dilatation of the pupil of the right eye, in 1940, with paredrine and homatropine solutions was ineffective in raising the tension above 21 mm. Hg. However, on August 31, 1940, tension in the right eye was 53 mm. This was normalized with pilocarpine. Again, on April 29, 1942, tension in the right eye was 46 mm. and on June 10, 1942, while the patient had been using eserine (0.5 percent) the tension was 67 mm. An iridectomy was done on the right eye. The tension then remained normal until the patient's death in April, 1943.

Case 18. This 51-year-old woman experienced her first ocular symptoms in July, 1940, while viewing a movie. The eyes were not red, but the vision was blurred. Reading frequently caused blurring of vision. When first seen at the Infirmary in December, 1940, tension was: R.E., 70 mm. Hg (Schiotz); L.E., 46 mm. Both eyes were pale. Miotics caused reduction of tension to normal within 30 minutes. On December 21, 1940, after being asked not to use the prescribed pilocarpine in the right eye that morning, the patient's tension was 60 mm. in the right eye, and 28 mm. in the left. Miotics reduced the tension of the right eye from 60 to 24 mm. Hg within 20 minutes. Provocative dilatation of the pupil of the left eye with 2-percent euphthalmine on January 9, 1941, caused a rapid rise in ten-

sion from 28 mm. Hg to 60 mm., in 30 minutes. Repeated attacks of high tension in the right eye occurred on April 12, 1942, and on four occasions in February, 1944, despite the punctual use of pilocarpine and eserine, 5 to 8 times daily, as directed to do at various times. The eyes were always pale. This patient was put on a combination of 1-percent neosynephrine, 0.25-percent physostigmine salicylate, and 2-percent pilocarpine nitrate, 6 times daily. During a two-month period of observation, this patient experienced two attacks of hypertension, each of which was relieved after further instillations. This patient felt that the addition of neosynephrine was of some help; however, I could not be certain of its value in this case.

Case 22. This 45-year-old woman had experienced pain in her left eye about three times weekly for three years before being seen at the Infirmary in 1939. These episodes were sometimes associated with excitement and sometimes occurred after attendance at a motion-picture theatre. The pain usually lasted overnight and was never associated with redness of the eyes. On June 24, 1939, a homatropine refraction was done, following which the tension was found to be: R.E., 40 mm. Hg (Schiotz); L.E., 80 mm. The eyes were pale. Miotics reduced the tensions to normal within an hour. Provocative dilatation of the pupil of the left eye with 2-percent euphthalmine subsequently caused an acute ocular hypertension, yet the eye remained free of any injection. Tension rose from 26 mm. Hg to 57 mm. in 40 minutes.

On February 24, 1941, the patient experienced a sudden attack of pain, redness, halos, and headaches which lasted for two days before she was seen at the Infirmary. Tension was 68 mm. Hg (Schiotz) in the left eye despite the use of pilocarpine. This was relieved with miotics. On October 20, 1941, associated with

the serious illness of a close relative, the patient experienced another similar attack in the left eye. This was relieved by bilateral iridectomy-sclerectomies.

Case 23. This 50-year-old man noticed halos after seeing motion pictures two months before the onset of a severe attack of acute glaucoma. The halos disappeared by the following morning. The eyes were not red. On the night of December 19, 1940, the patient did not sleep well. At 10 o'clock the next morning the right eye was very painful and swollen. Miotics given the following day were ineffective in reducing the tension. An iridectomy-iridencleisis was performed on the fifth day. Two separate attempts to provoke acute glaucoma by dilatation of the pupil of the left eye with euphthalmine, paredrine, and homatropine solutions were unsuccessful. The pupil could not be dilated beyond 6.5 mm.

On December 30, 1944, the patient was awakened at 2:30 o'clock in the morning by pain in the left eye. He had been using doryl drops, three times daily. The eye was red and hard when seen at the Infirmary on January 1, 1945, when an iridencleisis was performed.

Case 24. This 57-year-old woman had noticed ocular discomfort after seeing motion pictures or after reading for several months previous to being seen at the Infirmary on February 21, 1938. A week before admission, her right eye was red and painful on awakening one morning. The symptoms continued for a week. When seen at the Infirmary, tension in the right eye was 60 mm. Hg (Schiotz). Miotics were ineffective in reducing the tension below 40 mm. An iridectomy was performed four days later. Provocative dilatation of the left pupil in April, 1946, caused an increase of tension from 23 to 39 mm. in 2½ hours.

Case 27. This 27-year-old man had experienced blurring of vision, pain, and often slight injection of the right eye in-

termittently about twice weekly since the age of 17 years. These episodes usually occurred after attending a motion-picture theatre or after reading, usually at night. On November 29, 1938, a homatropine refraction was done at the Infirmary. The pupil of the right eye never returned to its normal diameter. Two days after the refraction examination, the patient began to have pain and slight injection of the right eye. When seen at the Infirmary four days later, the tonometric reading for the right eye was 60 mm. Hg (Schiotz). The eye was very slightly injected. Miotics were ineffective in reducing the tension to normal. A trephining operation done on January 11, 1939, on the right eye was unsuccessful. It was followed on February 8, 1939, by cyclodialysis of the right eye. This was successful. The cleft was visible gonioscopically. However, nearly four years later, on December 8, 1942, tension in the right eye was elevated to 52 mm. Hg (Schiotz). On eserine therapy, the tension returned to normal and has remained normal since on miotics. The cyclodialysis cleft is open but shallow.

This is probably the youngest case of true acute glaucoma on record, having started with prodromata at about the age of 17.

Case 32. This 73-year-old man awoke one morning with blurring of the vision of the right eye, slight injection of that eye, and slight headache. He went to the Infirmary the next day, after the eye had become worse. It was then red and the tension was 70 mm. Hg (Schiotz). Miotics were only temporarily effective. A trephining was done in October, 1940. Provocative dilatation of the pupil of the left eye was ineffective in causing glaucoma. The pupil could not be dilated beyond 5 mm. In June, 1946, this patient was sent a card requesting his appearance for examination as a part of this study. When seen, the eyes were pale. Tension in the right eye was well controlled. Tension in

the left eye was 60 mm. Hg (Schiotz). The retinal arteries pulsated. The tension was reduced to 27 mm. within one hour after instillation of a drop of 0.5-percent eserine. The patient stated that he had seen halos during the past two months. The eye had never been red. He had not used miotics for several months.

Case 40. This 60-year-old man experienced aching of the right eye without blurring of vision or redness of the eye one evening after supper in July, 1939. He awoke the next morning with the right eye red and its vision blurred. Three or four days later he consulted a physician, who referred him to the Infirmary. The tension in the right eye was 82 mm. Hg (Schiotz). Miotics were ineffective. An iridotomy was performed on August 12, 1939. Provocative dilatation of the left eye with paredrine and homatropine solutions for three hours caused no increase in the tension. The pupil did not dilate beyond 6 mm. The miotics were stopped after the operation on the right eye.

On January 28, 1945, the patient experienced a typical attack of acute glaucoma in the left eye. Miotics were effective in reducing the tension to normal. On March 1, 1945, in spite of the use of miotics, the patient experienced another such attack in the left eye. On March 10, 1945, a left iridencleisis was done.

DISCUSSION OF THESE CASES

The discussion of these cases will be considered under two main headings: I. The relation of acute glaucoma to narrow-angle glaucoma in general. II. Miotics in acute glaucoma.

I. THE RELATION OF ACUTE GLAUCOMA TO NARROW-ANGLE GLAUCOMA IN GENERAL

In recent years, there has been a tendency to substitute the term *narrow-angle glaucoma* (Barkan) for the previous classification of acute and chronic-congestive

glaucoma. This is a definite advance in our thought and helps avoid the inclusion of a description of the vascular reaction of the eye in the diagnosis. Yet the terms are, strictly speaking, not synonymous, since narrow-angle glaucoma covers a wider range of cases:

1. Classical "acute congestive glaucoma"
2. "Chronic congestive glaucoma"
3. Dilatation glaucoma
4. "Preglaucoma"
5. Acute glaucoma due to lenticular intumescence
6. Acute glaucoma due to dislocation of the lens into the anterior chamber
7. Mixed glaucoma (including acute glaucoma as one form)

I, therefore, do not ordinarily use the term but prefer to include the first four conditions listed above in the term "primary" acute glaucoma and to consider the others separately. Demonstrations of the relationship between the first four is the basis of this grouping and is one of the purposes of this paper.

The fallacy of using the terms congestive and noncongestive as part of the diagnosis has already been pointed out.¹ In the follow-up study herein described, three (cases 2, 18, and 32) of the 11 patients with spontaneous attacks of acute glaucoma had no externally visible ocular congestion. One patient (case 32) was found only accidentally to have an obstructed angle and acute glaucoma. He had no complaints. The eye was not red. In Case 18 the angles were so shallow that on previous occasions it was possible to bring the intraocular pressure quickly to a high level simply by avoiding a single instillation of the miotic being used. The clinical picture and history in Cases 2 and 18 were typical of "acute congestive glaucoma," in that they had spontaneous attacks of high intraocular pressure and shallow angles which became obstructed,

but atypical in the absence of congestion. By avoiding the term describing the absence or presence of congestion, these cases can be properly classified.

The confusion is emphasized in Case 17 in which a woman, then 44 years of age, had an acute glaucomatous attack in the right eye in January, 1935. The eye was not red. It was treated surgically. The diagnosis was acute glaucoma. Five years later, during a study of the other eye, the resident, in reviewing the original history of the acute episode, made a note on the hospital record stating that the original diagnosis must have been incorrect because the eye had been pale, and that the diagnosis should have been "chronic compensated glaucoma." That the diagnosis of acute glaucoma was correct is shown by the presence of a typical cataracta glaucomatosa acuta (Glaukomflecken of Vogt) in the right eye.

The relationship between the congested and noncongested eyes with acute glaucoma will be further demonstrated in the discussion of the relationship between the first four groups listed above.

The Relationship between Acute Glaucoma and Chronic Congestive Glaucoma.

I consider "chronic congestive glaucoma" to be a form of ordinary acute glaucoma in which the episodes recur repeatedly and then subside. When one of the attacks persists, it is considered, of course, an acute attack, but it is in the prodromal period that diagnostic confusion appears. In going over the records of this series of 45 cases of acute glaucoma, 24 were found to have had prodromal episodes. Some had been diagnosed as chronic congestive glaucoma during one of the prodromal attacks while others, in whom the episode was still in a noncongestive phase, were called "chronic compensated glaucoma" (which I have always considered to be synonymous with

glaucoma simplex). However, when an ultimate acute persistent attack occurred in these cases, the diagnosis then became acute glaucoma.

An example will suffice. B. M., a 66-year-old man, in 1939, first noticed episodes during which he experienced decreasing vision, headaches, and saw rainbows about lights, in 1937. He finally had an acute glaucomatous attack, with slight injection of the left eye, in June, 1939. This was successfully treated by trephination. The case history was not included in the original series of cases only because the diagnosis of "chronic uncompensated glaucoma" had been made. Tension in the right eye remained below 15 mm. Hg (Schiotz) on five examinations from October, 1940, through March, 1941. Then, on April 15, 1941, a typical acute attack occurred in spite of the continuous use of pilocarpine. The eye did not respond to pilocarpine and eserine. A trephination was successfully performed. This case demonstrates the fact that our separation of "acute" and "chronic congestive glaucoma" has been an artificial one.

The Relationship between Acute Glaucoma and Dilatation Glaucoma.

During the period when I was privileged to organize the Glaucoma Clinic at the Illinois Eye and Ear Infirmary at the instigation of, and under the direction of, Dr. Harry S. Gradle, several instances occurred in which, after the use of cycloplegics for refraction, the ocular tension was found to be elevated to 60 mm. Hg (Schiotz) or more. The eyes were pale, and, except for pulsation of the retinal arteries, which were clearly visible, no other abnormalities were evident. The use of pilocarpine or eserine promptly brought the tension down to normal. Attempts at classification led to the same difficulties previously mentioned because of the lack of congestion. Most of these

cases were incorrectly diagnosed as "chronic compensated glaucoma" for lack of a better designation in the classification in general use.

The relation between these two types of cases is shown in this series of cases. Six had typical spontaneous acute glaucoma in one eye, and acute glaucoma following dilatation for refraction, examination, or accidentally, in the other eye (cases 1, 7, 8, 14, 36, and 41). The histories of the presence or absence of congestion indicated that, in all instances where dilatation was the cause of the acute attack, the eye was pale for one to two days before the pain and redness began. More specific relationship between the two groups is evident from the history in Case 2 in which one eye first had an attack of acute glaucoma following dilatation of the pupil before refraction, and four years later, the same eye was involved in a spontaneous attack.

I am convinced that there is no difference in the pathologic conditions in spontaneous typical acute glaucoma and acute glaucoma following dilatation. Here again the absence of congestion should be of no significance in the classification. If the situation is recognized during the early noncongestive phase and the tension is relieved by miotics, there is difficulty in calling the condition "acute congestive glaucoma." However, if the eye is seen after a longer period and is in a congestive phase, that term would fit.

The cases of glaucoma following provocative dilatation fall into the same classification. In the series considered here, two cases (24, 15) had spontaneous attacks of acute glaucoma in one eye and high tension following provocative dilatation in the other eye. In one of these, a spontaneous attack later occurred in the eye which had shown a positive provocative test. In three other cases, the same eye had a spontaneous acute attack which

was relieved and subsequently showed a positive provocative test (cases 18, 29 and 37). Since these cases were under observation at the time of the tests, the tension was brought back to normal during the noncongestive phase. If they had been allowed to remain at the high tension, some would undoubtedly have passed into the congestive phase. In Case 8, a provocative test was done with euphthalmine. The tension was 15 mm. in each eye. After one hour it was 18 mm. in each eye. The test was correctly considered to be negative by the resident, and the patient allowed to leave, but without instilling a miotic. The next day a typical congestive attack began in the right eye, requiring surgery.

As a result of the findings in the provocative tests, I pointed out in 1941² that provocative tests for glaucoma may be divided into two groups. One group for eyes with normal anterior-chamber depth—the caffein test (in my experience of little value), the drinking test, and the anterior-chamber puncture tests, in the order named. In another group of tests for eyes with shallow chambers and angles, the dark-room test should be done first, followed by a mydriatic test with 2-percent euphthalmine. If negative, 1-percent paredrine is then used, and, if still negative, homatropine. I pointed out that negative results from these tests are of no significance. In the series considered here, four patients had negative responses to provocative dilatations (cases 16, 23, 32, 40) but later had spontaneous acute attacks. Three of the four (cases 16, 23, and 32) had been examined gonioscopically before, during, and after mydriasis. The angles were patent but very narrow. The gonioscopic findings in these cases, as well as the majority of the other provocative tests, were previously mentioned.¹ Pointing out the relationship between positive provocative pupillary dilatation and acute

glaucoma has the disadvantage of emphasizing this particular mechanical aspect of acute glaucoma. One must not lose sight of the neurovascular congestive factor which is more important in spontaneous acute glaucomatous attacks.

The Relationship between Acute Glaucoma and "Preglaucoma."

Gradle's recent paper³ entitled "Preglaucoma" considers the term to include two forms: "first, the acute, shallow-angle type with the manifestations of acute decompensation; and second, the chronic, deep-angle form." In the case of the shallow-angle type, I believe that, during the normal interval between episodes, the term "preglaucoma" is correctly applicable, since at that time the eyes are entirely normal in their drainage mechanism. However, to call any phase of simple glaucoma "preglaucoma" is, in my opinion, not in keeping with our ideas regarding this condition, since in simple glaucoma the tension, whatever it is, is too high for that particular eye. At no time, then, are we sure that we are not dealing with active simple glaucoma. To avoid confusion, I believe the term should be used only in reference to an eye with potential acute glaucoma. Perhaps the term might better be "pre-acute-glaucoma."

Mixed Glaucoma.

Because one is dealing with a particular type of glaucoma, there is no reason why acute glaucoma may not be superimposed, if the anatomic predisposing factors are present. An elderly patient with simple glaucoma over a period of years does gradually get some shallowing of the chamber due to the increasing lens size. If the same patient has the anatomically (relatively) shallow chamber to begin with, he may develop an acute attack spontaneously or following dilatation. Similarly, patients with other forms of glaucoma may de-

velop a superimposed true acute glaucoma. Two cases of capsular exfoliation, with superimposed acute glaucoma follow.

J. F., a 71-year-old man, in 1939, suddenly noticed poor vision in the right eye in September, 1939. He was seen at the Infirmary where the tension was found to be 60 mm. Hg (Schiotz) in the right eye. The anterior chambers were shallow. Es-erine rapidly brought the tension to 32 mm. Typical capsular exfoliation was present in the right eye only. The right lens was removed because of cataract. The tension remained slightly above normal in spite of an open angle. This was considered characteristic of "glaucoma capsulare." In March, 1946, the patient was being prepared for removal of a cataract from the left eye, the one without capsular exfoliation. Preoperative dilatation of the left pupil caused an elevation in tension from 25 mm. to 49 mm. Hg (Schiotz) in two hours and return to upper normal after administration of es-erine. A subsequent water provocative test to help rule out the possibility of simple glaucoma was negative.

C. C., a 66-year-old man, in 1940, experienced a sudden attack of acute pain in his left eye and noticed rings around lights on May 18, 1940. This patient was seen at the Infirmary four days later. The tonometric readings were: R.E., 25 mm. Hg (Schiotz); L.E., 73 mm. All the findings of a congestive attack of acute glaucoma were present in the left eye. Both anterior chambers were shallow. Capsular exfoliation was present in each eye. The left eye did not respond to miotic therapy and on May 27, 1940, an iridectomy was performed on this eye. The tension remained normal thereafter.

The possibility of acute glaucoma superimposed on another type of glaucoma, especially simple glaucoma, should be kept in mind. However, in the case of simple

glaucoma, it is often very difficult to be certain that a mixed type is really present. An example of what I consider to be a probable case follows:

Mrs. L. F., aged 58 years in 1945, was first seen at the University of Illinois Eye Clinic on July 18, 1945. Her corrected visual acuity was 20/20 in each eye. The right peripheral visual field with a 5 mm. white target at 170 mm. was constricted to 55 degrees, temporally; 45, superiorly; 35, nasally; and 25, below; with a nasal step to 5 degrees in the upper nasal quadrant. The left field was constricted slightly to 65 degrees, temporally; 40, above; 50, nasally; and 50, inferiorly. The anterior chambers were shallow. The tonometric readings on August 20, 1945, were: R.E., 35 mm. Hg (Schiotz); L.E., 31 mm. A diagnosis of glaucoma simplex was made and treatment with pilocarpine instillations instituted. However, the tension stayed up, reaching 42 mm. in the right eye and 47 mm. in the left, on November 28, 1945. In January and February, 1946, the tension remained normal on pilocarpine. In May, the patient was started on di-isopropyl fluorophosphate (0.05 percent) in the right eye. The tension remained normal until May 27, 1946, when the tension was: R.E., 30 mm.; L.E., 21 mm. on June 1st, the tension was 39 mm. in the right eye; 20 mm. in the left. A drop of 0.1-percent D.F.P. was instilled. On June 3rd the tension was: R.E., 50 mm.; L.E., 23 mm. Gonioscopy at this time showed such a narrow angle in the right eye that the trabecular wall could not be seen. The patient was returned to pilocarpine therapy, and the tension was reduced. In July, the patient was seen again with an acute attack of glaucoma in the right eye. An iridectomy was performed.

II. MIOTICS AND ACUTE GLAUCOMA

It appears rather significant that approximately 27 percent of a series of

TABLE 1
SIGNIFICANT FOLLOW-UP FINDINGS IN 45 CASES OF ACUTE GLAUCOMA

Case Number and Eye	Presence of Prodromata	Attack Spontaneous (S) or Due to Dilatation (D)	Provocative Dilatation 1940	Provocative Dilatation 1946	Attack during Follow-up Interval	Presence or Absence of Injection	Use of Miotics during Follow-up Interval
			E = Euphthalmine P = Paredrine HA = Homatropine				
1. R L	Yes No	S D					
2. R L	No Yes	— D	HA neg. —	HA neg. —	— S	— Pale	— Pilo
3. R L	Yes No	S S					
4. R L	Yes Yes	S S					
5. R L	Yes ?	S S					
6. R L	No No	S —	P neg. —		— S	— Inj.	— Pilo
7. R L	No No	D S					
8. R L	No No	D S					
9. R L	Yes No	S —	P, HA neg. —	HA neg. —	S —	Inj. —	Pilo —
10. R L	No No	S —	P, HA neg. —	HA neg. —			
11. R L	No No	— D	E, P, HA neg. —				
12. R L	No No	— D	E, P, HA neg. E positive		Could not be followed		
13. R L	No No	S S					
14. R L	No No	D S					
15. R L	No No	S —	P-E positive —		— S	— Inj.	— ?
16. R L	Yes No	S S	P, HA neg. —		S —	Inj. —	Eserine 4% —
17. R L	Yes No	S —	E, HA neg. —	E, HA neg. —			
18. R L	Yes Yes	S S	E positive —		S —	Pale —	Pilo —
19. R L	No No	— D	HA neg. E neg. HA positive		Could not be followed		
20. R L	No No	S S					
21. R L	No No	D D					
22. R L	No Yes	D D	E positive —		— S	— Inj.	— Pilo
23. R L	Yes No	S —	E, P, HA neg. —		— S	— Inj.	— Doryl
24. R L	Yes No	S —		HA positive —			
25. R L	No No	S S					
26. R L	Yes Yes	S S					

TABLE 1—Continued

Case Number and Eye	Presence of Pro-dromata	Attack Spontaneous (S) or Due to Dilatation (D)	Provocative Dilatation 1940	Provocative Dilatation 1946	Attack during Follow-up Interval	Presence of Absence of Injection	Use of Miotics during Follow-up Interval
			E Euphthalmine P = Paredrine HA = Homatropine				
27. R L	Yes No	D —			S (after cyclo)	?	No miotics
28. R L	Yes No	S S					
29. R L	Yes No	S —	P positive P, HA neg.				
30. R L	No Yes	— S					
31. R L	Yes Yes	S S	{ E neg. P, HA positive		— HA positive		
32. R L	No No	S —	— HA neg.		— S	— Pale	— Did not use miotics
33. R L	No No	S S					
34. R L	Yes No	S —	S		Could not be followed		
35. R L	No No	S S	P neg. —				
36. R L	No No	D S					
37. R L	Yes No	S S	— HA positive				
38. R L	Yes No	S S					
39. R L	No No	S S					
40. R L	No No	S —	— HA neg.		— S	— Inj.	— No miotics
41. R L	Yes No	S D					
42. R L	No No	S S					
43. R L	Yes No	S S	Could not be followed				
44. R L	No No	S S					
45. R L	Yes Yes	S S	— E, HA neg.				

cases of "primary" acute glaucoma should show some important change over a period of only six years, particularly since most of the patients (8 of the 12) continued to use miotics during that time. The percentage of cases with significant change is much greater (50 percent), if one considers only the unoperated cases and those available for follow-up study. The findings in the series are shown in Table 1. In Case 2, the patient could not

be considered to have been on adequate amounts of miotics. In Cases 9, 18, 22, and 23, the patients were questioned carefully to be certain that one or more instillations of the drug had not been missed on the day of the acute episode. In the three other cases, this may possibly have been what happened.

The question arises: Why, especially in view of the continued use of miotics in most instances, should patients develop

spontaneous acute glaucoma even when previous provocative dilatation of the pupil was ineffective in elevating the tension? There are several phases to the answer to this question.

First, as we have already shown,⁴ patients with the anatomical predisposition to acute glaucoma become even more predisposed with the passage of time. The anatomic predisposition is due to relative shallowness of the angle of the anterior chamber which results from shortness of the eyeballs (usually manifested in hyperopic refractive errors), increased thickness of the iris or, occasionally, an abnormally small cornea and anterior segment. It has been shown⁴ that there is a relationship between refractive error and anterior-chamber depth in normal eyes. In the series of cases of acute glaucoma reviewed here, I found that hyperopic error was predominant as might be expected with shallow chambers. However, this series was too small to determine this factor accurately. I, therefore, studied a series of 140 eyes with acute (narrow-angle) glaucoma* in which the refractive error was recorded. These had an average hyperopic error of 2.72 diopters. Of the 140 eyes, only seven had myopic errors, the spherical equivalents of which were -4.75, -3.62, -2.62, -2.12, -0.50, -0.12, and -0.12 in patients aged 80, 80, 73, 70, 70, 68, and 37, respectively.

The time factor results from the gradual but constant increase in thickness of the crystalline lens as new lens fibers are added. This tends to increase the shallowness of the anterior chamber. Eventually a point is reached where miotics alone keep the angle free (as in Case 18). Finally, even miotics may be ineffective but, fortunately, such cases are infrequent.

* Taken in most instances from the records of Drs. Harry S. Gradle and S. J. Meyer who kindly permitted the use of their material.

The second factor involved in the answer to our question is the congestive effect of the miotic drugs. The fact that the same drugs are used for both acute and simple glaucoma has led to the false inference that the pathologic findings in both conditions are the same. These drugs have two effects, miosis and vasodilatation.⁵ The miotic action is the one which we seek in acute glaucoma while the vasodilatation effect is that sought in simple glaucoma. However, the vasodilatation factor is a disadvantage in cases of acute glaucoma where the congestion further embarrasses the already too narrow angle entrance.

Troncoso, in a recent review of Busacca's *Elements de gonioscopie normale, pathologique et experimentale*,⁶ stated that "Busacca still clings to the opinion of Salzmann, who stated the belief that atropine enlarges the chamber sinus and physostigmine narrows it. Sugar has shown that the converse is true."

Actually, I have pointed out only that the converse is *also* true. The effect of either drug on the angle depends on the interplay of two antagonistic actions of each drug. Physostigmine tends to narrow the angle by its vasodilating and its cyclotonic action but at the same time tends to open the angle by constricting the pupil. Atropine tends to widen the angle by its mechanical decongestive action but simultaneously tends to narrow the angle by increasing the iris thickness through folding.

The congestive effect of the miotic drugs is also evident clinically in patients with acute glaucoma in whom the attack is relieved by the miotic drug, but in whom, shortly afterwards, a reactive phase of increased intraocular pressure ensues, in spite of the continued use of powerful miotics. Case 9 is an instance of this. Another typical example of this follows:

Mrs. O. H. N., aged 51 years, was hospitalized at the Michael Reese Hospital in August, 1938, because of bilateral acute glaucoma. Instillations of 1-percent pilocarpine rapidly brought the tension down to less than 20 mm., but about 24 hours later tension in the right eye re-

probably also the reason why pilocarpine or eserine are not always effective in preventing the onset of an acute attack in the hitherto normal fellow eye of a patient who has just had, or recently had, surgical treatment for acute glaucoma in one eye.

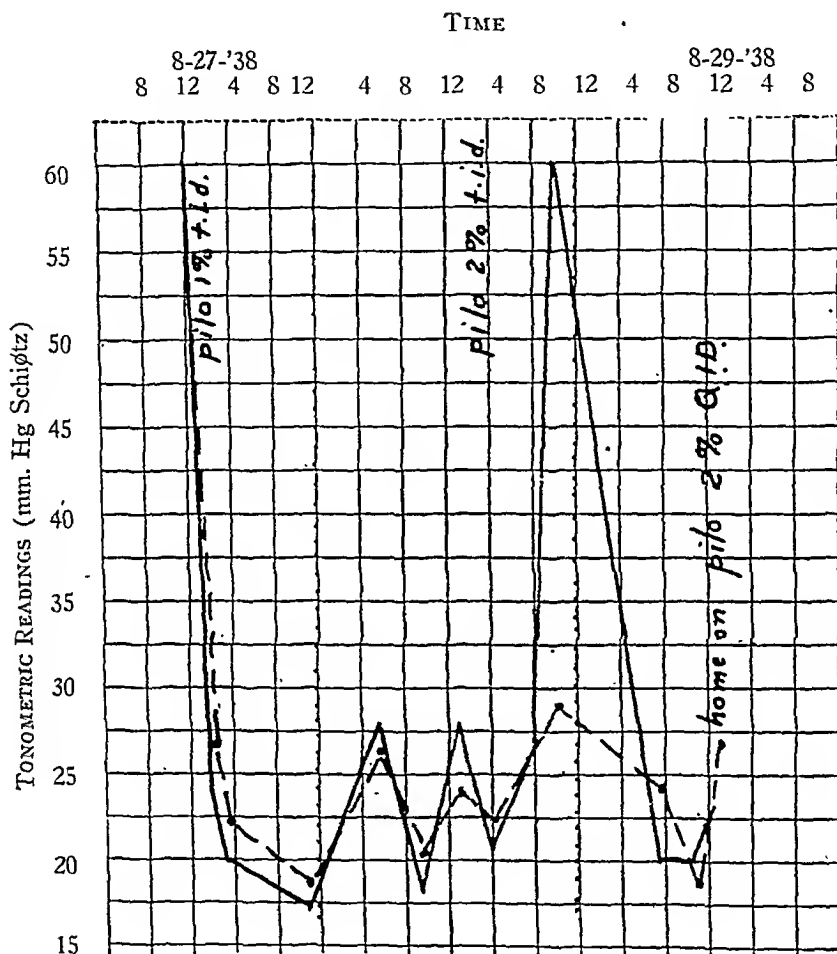


Chart 1 (Sugar). Case of Mrs. O. H. N. Instillations of 1-percent pilocarpine rapidly brought the tension down to less than 20 mm. Hg, but about 24 hours later tension in the right eye returned to 60 mm. Hg shortly after the instillation of a 2-percent pilocarpine nitrate. By the following morning it had returned to normal. (— Right Eye. --- Left Eye).

turned to 60 mm. Hg (Gradle-Schiøtz) shortly after the instillation of a 2-percent pilocarpine nitrate. However, by the following morning it had returned to normal. The tonometric readings are shown in Chart 1.

The congestive effect of the miotics is

Two interesting examples of such instances follow:

Mrs. J. P., aged 59 years, was examined in 1941 at which time she was found to be 3.75 diopters hyperopic in each eye. The tonometric readings (Schiøtz) were 22 mm. Hg in the right eye, and 20 mm.

in the left, an hour after euphthalmine dilatation. About the end of March, 1946, this patient began to have headaches on the left side. The left vision was blurred. An antiglaucoma iridectomy was done on the following day. On April 10, 1946, I saw this patient for the first time. The tonometric readings were: R.E., 20 mm. Hg (Gradle-Schiøtz); L.E., 22 mm. Pilocarpine nitrate was ordered for instillation in the other eye as a prophylactic measure. The next morning the patient experienced an acute glaucomatous attack in each eye which required surgery.

Mrs. L. F., aged 57 years, had had episodes of dimness of vision during which she saw halos about lights for five years. When she was seen in 1936, the tonometric readings were: R.E., 50 mm. Hg (Schiøtz); L.E., 26 mm. A cyclodialysis was done on the right eye. Eserine was instilled into the left eye. At 3 o'clock the following morning the patient began to have severe nausea. By eight, the left eye became very painful. The tension was 73 mm. Hg (Schiøtz). It did not respond

to miotics and a left iridectomy was done.

The obvious solution to the problem is the addition of a vasoconstrictor drug to the miotic to be used *only* in patients with shallow angles who show evidence of potential or prodromal acute glaucoma or an actual acute attack. To test the effect of such a combination of drugs I studied the duration of action and the effect on the pupil of 0.1-percent prinine hydrochloride, 1-percent neosynephrine and a combination of 2-percent pilocarpine nitrate and 1-percent neosynephrine on a small series of patients, with normal eyes, between the ages of 42 and 68, the age group usually affected by acute glaucoma. The results are shown in Table 2.

The findings indicated that 0.1-percent prinine and 1-percent neosynephrine have an effect on the pupil for about 3 or 3½ hours. The combination of 2-percent pilocarpine and 1-percent neosynephrine mainly manifests the pilocarpine effect which is dominant and usually "covers" the pupil-dilating effect adequately.

The combination of 2-percent pilocar-

TABLE 2
EFFECT OF DRUG INSTILLATIONS ON PUPILS OF NORMAL HUMAN EYES
(A) 1 DROP 0.1-PERCENT PRININE HYDROCHLORIDE

Patient	Age	Original Pupil Size	Pupil Size (mm.) After Drug Instillation							
			½ Hr.	1 Hr.	1½ Hrs.	2 Hrs.	2½ Hrs.	3 Hrs.	3½ Hrs.	4 Hrs.
1. R	54	2.3	4.0	5.0	5.5	4.0	4.0	4.0	3.5	3.2
1. L	54	2.3	4.0	5.0	5.5	4.0	4.0	4.0	3.5	3.2
2. R	68	5.0	5.0	6.0	7.5	5.5	5.0	3.5	3.5	3.5
2. L	68	5.0	5.0	6.0	7.5	5.5	5.0	3.5	3.5	3.5
3. R	50	2.3	3.0	3.2	3.5	3.0	2.3	2.3	2.5	2.5
3. L	50	2.3	3.0	3.2	3.5	3.0	2.3	2.3	2.5	2.5
4. R	55	2.4	3.0	2.5	3.0	3.0	2.5	2.5	3.5	3.0
4. L	55	2.4	3.0	2.5	3.0	2.5	2.5	2.8	3.5	3.0
5. R	47	3.5	4.0×6.0	5.0×6.0	7.0×8.0	6.0×7.0	6.0	5.0×6.0	5.0	4.0×5.0
5. L	47	3.5	5.0	6.5	8.0	7.5	6.0	6.0	6.0	5.0
6. R	45	3.0	4.0	3.5	3.0	3.5	3.0	2.7	2.7	3.0
6. L	45	3.0	4.0	3.5	3.0	3.5	3.0	3.0	3.0	3.0
7. R	67	3.0	3.0	2.7	2.5	2.5	2.2	2.5	2.5	2.5
7. L	67	3.0	3.0	2.7	2.5	2.3	2.2	2.5	2.5	2.5
8. R	45	2.5	3.0	2.5	3.0	3.2	2.5	2.5	2.5	2.5
8. L	45	2.5	3.0	2.5	3.0	3.2	2.5	2.7	2.7	2.5
9. R	49	2.5	3.0	3.2	4.0	2.5	3.0	2.5	2.5	2.5
9. L	49	2.3	3.0	3.0	3.5	2.2	3.0	2.5	2.5	2.5
10. R	56	2.5	2.3	2.5	3.0	3.0	2.5	3.0	3.0	3.0
10. L	56	2.5	2.3	2.5	3.0	3.0	2.5	2.5	3.0	3.0

TABLE 2

(B) 1 DROP OF 1-PERCENT NEOSYNEPHRINE HYDROCHLORIDE

Patient	Age	Original Pupil Size	Pupil Size (mm.) After Drug Instillation							
			$\frac{1}{2}$ Hr.	1 Hr.	1 $\frac{1}{2}$ Hrs.	2 Hrs.	2 $\frac{1}{2}$ Hrs.	3 Hrs.	3 $\frac{1}{2}$ Hrs.	4 Hrs.
1. R	58	2.5	3.0	4.0	3.0	3.5	3.0	3.0	3.0	2.5
1. L	58	2.5	3.0	4.0	3.0	3.5	3.0	3.0	3.0	2.5
2. R	59	2.5	3.5	4.0	3.0	3.5	3.5	3.0	2.5	2.5
2. L	59	2.5	3.5	5.0	4.0	3.5	3.5	3.0	3.0	2.5
3. R	54	2.3	3.0	5.0	4.0	4.0	3.5	3.0	2.5	2.5
3. L	54	2.3	3.0	5.0	4.0	3.5	3.5	2.5	2.0	2.0
4. R	47	3.5	4.0	4.0	4.0	4.0	4.0	3.5	3.5	3.5
4. L	47	3.5	4.0	4.0	4.0	4.4	4.0	3.5	3.5	3.5
5. R	45	3.0	3.5	4.0	3.0	3.0	4.0	3.5	3.0	3.0
5. L	45	3.0	3.5	3.0	2.5	2.5	3.5	3.0	3.0	3.0
6. R	50	2.5	4.0	4.0	4.0	3.5	2.5	3.0	3.0	3.0
6. L	50	2.5	4.0	4.0	3.0	3.0	2.5	3.0	3.0	3.0
7. L	53	3.0	4.5	5.0	4.0	4.0	4.0	3.2	3.0	3.0
8. R	54	2.5	4.0	4.0	4.0	4.5	3.0	3.0	2.5	2.5
8. L	54	2.5	4.0	4.0	4.0	3.5	3.0	3.0	2.5	2.5
9. R	44	3.0	3.5	3.5	3.0	3.5	3.5	3.5	3.0	3.0
9. L	44	3.0	3.5	3.5	3.0	3.5	3.5	3.0	3.0	3.0
10. R	60	2.5	3.0	3.0	3.0	3.0	2.7	2.5	2.5	2.5
10. L	60	2.5	3.0	3.0	3.0	2.5	2.7	2.5	2.7	2.5

TABLE 2

(C) 1 DROP OF COMBINED 2-PERCENT PILOCARPINE NITRATE AND 1 PERCENT NEOSYNEPHRINE HYDROCHLORIDE

Patient	Age	Original Pupil Size	Pupil Size (mm.) After Drug Instillation							
			$\frac{1}{2}$ Hr.	1 Hr.	1 $\frac{1}{2}$ Hrs.	2 Hrs.	2 $\frac{1}{2}$ Hrs.	3 Hrs.	3 $\frac{1}{2}$ Hrs.	4 Hrs.
1. R	62	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
1. L	62	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
2. R	62	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.5	3.5
2. L	62	4.0	4.0	4.0	3.5	3.5	3.5	3.5	3.5	3.5
3. R	48	2.5	2.5	2.5	2.5	2.5	2.5	2.2	2.0	2.5
3. L	48	2.5	2.5	2.5	2.5	2.5	2.5	2.2	2.0	2.5
4. R	45	3.5	2.0	3.0	2.5	3.0	3.0	3.0	3.0	3.0
4. L	45	3.5	2.0	3.0	2.5	3.0	3.0	3.0	3.0	3.0
5. R	60	3.5	3.0	3.5	3.5	3.0	3.0	3.0	3.0	3.0
5. L	60	3.5	3.0	3.5	3.5	3.0	3.0	3.0	3.0	3.0
6. R	56	7.0	3.0	3.0	4.0	3.5	3.5	3.5	3.8	3.8
6. L	56	7.0	2.5	2.8	4.0	3.5	3.5	3.5	3.8	3.8
7. R	42	7.0	3.5	3.0	3.5	3.0	3.0	3.0	3.0	3.0
7. L	42	7.0	3.5	3.0	3.5	3.0	3.0	3.0	3.0	3.0
8. R	50	5.0	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.5
8. L	50	5.0	3.0	3.0	3.5	3.5	3.0	3.5	3.0	3.5
9. R	58	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
9. L	58	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
10. R	48	3.0	2.5	2.5	3.0	2.5	2.0	2.0	2.0	2.0
10. L	48	3.0	2.5	2.5	3.0	2.5	2.0	2.0	2.0	2.0

pine and 1-percent neosynephrine was then used for studies on glaucoma patients. The choice of drugs is empirical. Other stronger miotics and vasoconstrictor combinations possibly would be better since pilocarpine is a rather weak vasodilator. The ideal would be a single

drug with both effects. I know of no such drug, however. The recent reports of increased tension with the new drug D.F.P.⁸ suggests that occasional instances of angle blockage resulting from vasodilatation and cyclotonia might be prevented by the addition of a vasoconstrictor.

The combined drug was compared with 2-percent pilocarpine alone in 13 patients with early simple glaucoma to determine whether or not the vasoconstricting factor would cause elevation of the intraocular pressure. Each patient had discontinued the use of his own miotic drugs the previous night. The findings are shown in Table 3. In 12 of the 13 cases no difference was found in the two eyes. In the remaining case (8), the combined drug caused an increase in tension from 26 to 31 mm. Hg (Schiotz) and definite pupillary dilatation.

The combined drug was then given to 10 patients with narrow-angle glaucoma of the "pre-acute-glaucoma" type, as a substitute for the miotic drug being used. The drug was used for 4 to 6 weeks in each instance without untoward effect. Each of these patients had previously had provocative tests with mydriatics. Only one had responded with abnormal tension. He was included in the group given the combined drug. Tension in this patient's eye rose from 23 mm. Hg (Schiotz) to 45 mm. in one hour after instilling one drop of each of 2-percent neosynephrine and 1-percent paredrine. There had been no rise of tension with pilocarpine-neosynephrine.

Actually to prove that the combination of drugs is better than the miotic alone, one would have to show that the mixture was more easily able to control patients with narrow angles who are barely controlled by a miotic alone. By the very nature of the condition this would be practically impossible to prove unequivocally. (See Case 18.)

Serr⁷ studied the effect of pupillary dilatation and such drugs as pilocarpine, cocaine, and adrenalin in two cases of narrow-angle glaucoma (he designated them only as primary glaucoma and did not distinguish between simple glaucoma and acute glaucoma as separate entities).

He concluded that there is a definite threshold value of pupil diameter beyond which in each particular glaucomatous eye, the angle will be blocked; also that the vasoconstrictors such as cocaine and adrenalin decrease intraocular pressure in glaucomatous eyes by first decreasing the blood volume content of the globe and then by diminishing the secretion of aqueous by a toxic effect on the ciliary epithelium. He mentions that, by simultaneous use of adrenalin and miotics, a marked lowering of tension can be brought about. From my work with provocative pupillary dilatation in acute glaucoma, I believe that Serr's idea of a definite pupil threshold is correct only for a particular circumstance and that, under varying circumstances, the threshold changes. In spontaneous acute glaucoma where a congestive factor is usually present, the pupil width necessary to increase the intraocular pressure is much less than in dilatation glaucoma. Similarly, I believe that the vasoconstrictors are effective in narrow-angle glaucoma by decreasing the iris thickness, thus tending to open the angle. I know of no evidence that the secretion of aqueous is decreased by the vasoconstrictor drugs in the human eye.

The combination of miotic and vasoconstrictor drugs is suggested as a possible aid in the treatment of the acute (narrow-angle) type of glaucoma. It is not intended as a substitute for surgical therapy. In patients suffering from a congestive attack, the vasoconstrictor drug should be used in addition to eserine or any of the other strong miotics. In the treatment of patients with narrow-angle glaucoma in the noncongestive phase, the combined drugs should not be prescribed for home use until the effect on the pupil and tension have been observed by the oculist. Since the combined effect usually lasts only about three hours,

it may be necessary to instill the drugs more frequently than when pilocarpine alone is used.

CONCLUSIONS

1. In a series of 45 patients with "primary" acute glaucoma followed over a period of over six years, 26.6 percent showed some significant change during the follow-up period.

2. From a clinical point of view, classical "acute congestive glaucoma," "chronic congestive glaucoma," dilatation glaucoma and "preglaucoma" are all so intimately related as to constitute various clinical phases of the same condition.

The inclusion of descriptions of the vascular reaction of the eye in the main diagnosis is unjustified.

3. True acute glaucoma may be superimposed on other forms of glaucoma such as glaucoma capsulare and, unquestionably, even upon simple glaucoma.

4. Miotic drugs used in the treatment of acute glaucoma have the disadvantage of adding a congestive angle-narrowing factor where the angle is already anatomically too narrow. A combination of miotics with vasoconstrictors is suggested as a new approach to the therapy of acute glaucoma in all its phases.

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ARACHNODACTYLY (MARFAN'S SYNDROME) ASSOCIATED WITH ECTOPIA LENTIS

REPORT OF A CASE WITH PIGMENTATION OF THE CORNEA

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The clinical picture of Marfan's syndrome is that of a tall, thin individual with a saddened facies. His mobility is impaired because of muscular atrophy and faulty vision. Congenital defects are common and may involve the heart, joints, ears, lungs, ascending aorta, and palate. The muscular weakness has occasioned some investigation, and the usual finding is a normal reaction to electrical stimulation save that the response of the muscle is proportionate to the muscular atrophy.

Ocular changes are noted in about 60 percent of the cases, and include ectopic lenses, miosis with feeble or absent reaction to mydriatics, iridodonesis, variation in the intraocular pressure, divergent squint, myopia, coloboma of the lens, a thickened lens capsule, and megalocornea.

X-ray studies of the skeletal system reveal increased length of the metacarpals and phalanges, while the terminal phalanges are relatively more elongated. The long bones show no pathologic change other than elongation. Kyphosis and scoliosis are frequently observed, but perhaps this is due to relaxation of the ligaments.

Laboratory studies are usually non-revealing, save for alteration of the cytologic elements of the blood which occurs concomitantly with the associated congenital heart or pulmonary disease. The blood pressure and the basal metabolic rate are characteristically low in this asthenic type.

Marfan,¹ the French physician, in 1896, gave the first description of the syndrome which bears his name. In this presenta-

tion, his patient was a 5½-year-old girl who had long, slender feet and hands, elongated long bones, underdeveloped skeletal musculature, contractures of the joints, and retardation of the locomotor function. For this syndrome, Marfan selected the term *dolichostenomelia* to describe the feet and hands as being spider-like in configuration. In 1902, Méry and Babonneix² submitted the first roentgen study of the malshaped extremities of Marfan's original case, and suggested the term *hyperchondroplasia* in contrast to *achondroplasia*, because they noted enlargement of the cartilaginous portion of the epiphyses. Achard,³ in 1902, presented the second case to appear in the literature, and first used the term *arachnodactyly* to indicate that the feet and hands were spiderform in shape. This term has been given preference in the literature despite Marfan's initial use of *dolichostenomelia* to describe the shape of the hands and feet. Since Marfan's original description, Rados,⁴ in 1942, listed 204 cases which had been described through the year 1939.

The earliest description of the ocular changes is credited to Salle,⁵ who, in 1912, noted the presence of narrow pupils, shallowness of the anterior chamber, and normal optic papillae. Ormond and Williams,⁶ in 1923, added iridodonesis and dislocation of the lenses to the ocular findings.

The origin of this disease is entirely speculative. Dvorak-Theobald,⁷ in presenting the original histopathologic study of an eye from a patient who suffered from Marfan's disease, indicates that the

aberrant process is first noted about the fourth embryonic week, at which time, according to Ida Mann,^{8,9} the size of the mesodermal elements is determined by the presence of the optic vesicle. At this time some excitant is postulated by Dvorak-Theobald which causes megaloglobus. About the sixth fetal month, there is a suppression phase during which time growth and development is limited, and the trabecular tissue, dilator muscle of the iris, and pars iridica retinae are affected. It might be assumed that the skeletal abnormalities may be due to the same excitant and depressant action. Ida Mann, quoted by Morard,¹⁰ remarks that the "disturbances in Marfan's syndrome are probably only coördinated symptoms of a genotypic affection, producing general and ocular troubles which affect not only the mesoderm but the endocrine glands and ectoderm as well." In Burch's¹¹ paper, Mann further reflects that "one has to remember that various factors may account for the linking of defects. In the first place, the defect may be in a certain chromosome. Since the chromosome carries many genes mediating many different characters in various parts and various tissues, it is to be expected that superficially unrelated characters may be found to be related by their genic position in the blastomeres. There is no evidence to lead us to suppose that mesodermal and ectodermal structures are segregated in different chromosomes, and there is no inherent reason why the characters for the extremities should not be carried by the same chromosomes as certain eye characters."

The histopathologic findings as described by Dvorak-Theobald⁷ include megaloglobus, replacement of the dilator fibers of the iris by a "pink staining substance adjacent to the ectodermal pigment cells, incomplete formation of the pigment cells of the pars iridica retinae about half way between the iris border

and the base of the ciliary body, faulty placement of the angle of the anterior chamber in that it is anterior to the canal of Schlemm, faulty development of the circular muscle of the ciliary body, and elongation of the zonular fibers, allowing the lens to assume a spheroid shape."

One of the most interesting aspects of this syndrome is the hereditary and familial tendency; about 30 percent of all cases reported manifest such characteristics. While Stewart¹² and Moore¹³ have listed cases which occurred sporadically, it is generally agreed that arachnodactyly follows the Mendelian Laws, and Duke-Elder¹⁴ states that it is a dominant characteristic.

Marfan's syndrome is so well known in the ophthalmic literature that the presentation of just another case would not be of unusual significance. In the case herewith presented, however, one finds some very unusual features. The patient, a white man, aged 52 years, first came under the observation of one of us (J. V. C.) in January, 1946. He had been blind in the right eye since he was 14 or 15 years of age but, until two weeks before admission, had been able to see with the left eye by use of a cataract-thickness lens. At that time, he observed that a film seemed to have "dropped from above," blurring his vision except when he held his head down and looked "from under a curtain."

The patient was one of eight siblings whose mother was described as a tall, thin woman who wore thick correcting lenses. Four of the children were said to be normal, with no ocular complaints, whereas four had symptoms of Marfan's disease (fig. 1).

A sister, 55 years of age, had typical arachnodactyly. On ocular examination, she was found to be blind with glaucoma in each eye, which condition dated from an attempted cataract extraction at 13

years of age. A brother, aged 45 years, was not available for examination, but was described as being thin, with long hands and feet, having trouble with his eyes, and wearing very thick lenses. A younger brother, aged 38 years, was at home, having just received a medical discharge from the Army after being in several Army hospitals for eye examination. His ocular abnormalities were discovered in the Army when he was having a foreign body removed from his eye. He had dislocated lenses, arachnodactyly, iridodonesis, wore size-11 shoes, had high patellas, a sad countenance, and the dolichocephalic head of Marfan's syndrome. The fourth affected member of the family is the patient described. The other four children,

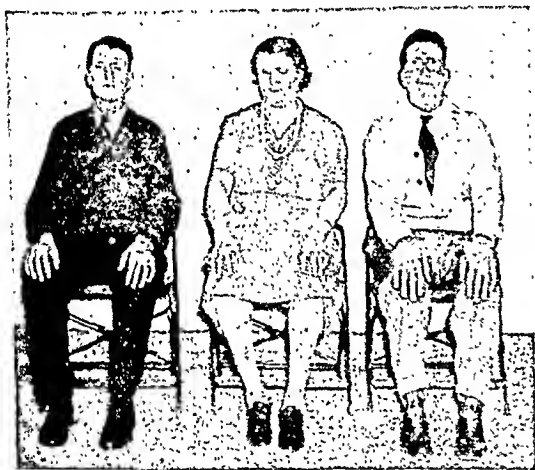


Fig. 1 (Cassady and McFarland). From left to right: the patient, his sister and brother; all with Marfan's syndrome, arachnodactyly and ectopia lentis.

their children, and one available grandchild were normal. Fortunately, three of the four afflicted individuals lived together and remained single. The fourth was married, but had no children.

Physical examination of the patient showed a tall, thin, doleful man of about 50 years of age. He had a dolichocephalic head with prominent supraorbital ridges and bossing of the frontal eminences. Sub-

cutaneous fat was absent, and there was a flaccidness to his muscular development. There was a striking hypotonicity of the thin muscles of his arms and legs. He had long extremities, spiderlike fingers and



Fig. 2 (Cassady and McFarland). This eye shows a yellowish-brown, granular, elevated, band-shaped corneal degeneration.

toes, high patellas, a flat chest, and excessive curvature of the soles of his feet.

The right eye (fig. 2) presented the unusual feature of this patient. There was a golden-yellow, band-shaped opacity involving most of the cornea of the right eye, extending horizontally from limbus to limbus. The surface was granularly elevated like crocodile leather. There was a strip of clear cornea above and a smaller strip inferiorly; clear, that is, except for the superficial vessels to the degeneration. On closer inspection, the vascularization was from the conjunctival vessels running in from all meridians to divide arborescently and interdigitate among many small vesicles. With slitlamp examination, a transparent-droplet formation was seen piled upon the corneal surface. On retroillumination, each vesicle was outlined by a pigment ring. On diffuse illumination, the pigment formation imparted a honey-yellow color to the granular band-shaped corneal degeneration. The iris, where it was visible above, showed iridodonesis but no evidence of inflammation, degenera-

tion, or vascularization. The eye was glaucomatous, and had been blind since the patient was about 15 years of age.

On external examination of the left eye, the cornea was clear, the pupil small, round, and regular. With ocular excursion, iridodonesis was noted. The corrected visual acuity was 20/200 when the patient tilted his head forward. On ophthalmoscopic examination, one noted a complete dislocation of the lens into the lower temporal vitreous chamber, and a bullous retinal detachment from above. The detachment partially obscured the optic papilla, and extended from the 10- to 2-o'clock positions, with a horseshoe-shaped tear at the 11-o'clock position, and a slight disinsertion from 12 to 1 o'clock. As the lens bounced in ocular motion, vitreous strands extending toward the detachment seemed to pull the retina farther down or allowed it to recede, depending upon the position of the lens in the vitreous chamber.

The optic disc appeared normal, and the attached retina was of usual color and appearance. The lens was spheric and small, with glistening, cholesterol-like crystals shining on its yellow-white surface. The lens usually floated in the lower part of the vitreous, where it would drop onto the retina when the patient was recumbent. With the patient prone, or when standing or sitting, it would come to the edge of the pupil leaving only enough room for him to see a little between it and the bullous detachment.

The problem this patient presented, then, was to save what little vision he had in his only remaining eye. The detachment fastened by vitreous strands to the movable lens apparently was being pulled loose by the traction between the vitreous and the lens. The pupil would not dilate to allow even this small spherical lens to migrate into the anterior chamber. There is a lack of dilator fibers present in

the iris (Dvorak-Theobald),⁷ which accounts for the fact that atropine did not affect the pupillary aperture. We were able to dilate the pupil slightly by repeated instillations of adrenalin or neosynephrin with cocaine, but neosynephrin or adrenalin alone were not effective in effecting pupillary dilation.

With the small pupil, a lens removal could not be successfully performed, for the lens could not be brought through it, therefore a preliminary iris sphincterotomy was done. The iris sphincter was cut nasally and temporally in the horizontal meridian. The sphincter was thicker than normal, and, after being cut, the pupil dilated ovally.

After sufficient time for recovery, the patient was turned face down with the foot of the bed elevated to try to get the lens into the anterior chamber. It would come to the edge of the pupil below, but not through the pupillary aperture. With track sutures, therefore, a conjunctival flap, and negative pressure by the eye speculum, the lens was brought into the anterior chamber area with a Weber loupe from the lower vitreous chamber, then grasped with a capsule forceps; the extraction was completed, and the wound closed with no appreciable loss of vitreous. The eye was softer than normal as the sutures were tied. The recovery from this part of the surgery (the lens extraction), as well as the previous preliminary sphincterotomy, was followed by a moderate striate keratitis.

As the operative reaction subsided, hemorrhage in the vitreous obscured the fundus reflex. The hemorrhage organized, while some posterior synechia developed. The endothelial surface of the cornea near the wound showed a few deep blood vessels. The eye was softer than normal. Treatment with nonspecific protein and X-ray therapy did not improve the visibility of the fundus through the vitreous

haze. The vision was limited to light perception and projection.

DISCUSSION

A diffuse pigmentation of the cornea such as was seen in this patient is of rare occurrence. The only similar instances of pigmentation of a band-shaped corneal degeneration that have been reported in the literature were those of Von der Heydt¹⁵ and Peppmueller.¹⁶ In their cases, there were no vascular nor inflammatory changes, and both occurred in patients with osteitis deformans (Paget's disease). The degeneration is of the outer layer of the cornea, hence, is epithelial. The pigmentation is located on the outside of the vesicles that are piled upon the corneal surface and diffusely invaded by blood vessels.

The cause for the pigmentation in this corneal lesion presents a most interesting problem. Klien-Moncreiff,¹⁷ in a chemical analysis of the pigment present in a corneal leucoma, found it to be hemosiderin. She believes the pigment diffused downward from the superior limbus through the intercellular spaces of the corneal epithelium.

Another theory which may obtain is that the pigment is akin to melanin. In support of this, we know from Redslob's¹⁸ studies that the basal cells of the limbal conjunctiva are all potential melanoblasts. Further, Redslob found the epithelium which covers the corneal surface to be achromogenic in normal condition; however, should a pathologic process ensue which entails vascularization, these cells become chromogenic. The query as to

where the pigment arises could be answered by Bloch's¹⁹ dopa reaction. This indicates whether a cell is a potential chromogen by its combination with 3-4 dioxyphenylalanin, or what Bloch chooses to call dopa. If the cell is a melanoblast, it is assumed to contain an oxydase ferment which, when in combination with dopa, will form a melaninlike pigment that distinguishes it as a chromogen. The blood stream is thought to be the site where dopa is carried to the cell and, when in contact with a cytoplasm of the proper type, pigment is laid down. The latter explanation would probably best fit the chromogenesis here, since the epithelial cells have undergone a cystic metaplasia wherein blood vessels freely invaded the area.

SUMMARY

A review of the literature of Marfan's syndrome emphasizes its hereditary and familial tendency. In the family reported, four of eight children were normal, whereas four manifested the syndrome, confirming its dominant hereditary trait.

The patient herein presented not only had the predominant characteristics of the disease (arachnodactyly and ectopia lentis) but also a detached retina, pulled loose by the dislocated lens. His pupil (due to a lack of dilator fibers) would not dilate with mydriatics.

A pigmented, band-shaped corneal degeneration was the unusual feature of this case, as such pigmentation of the cornea is extremely rare. A possible explanation of the origin of the pigment is postulated.

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NOTES, CASES, INSTRUMENTS

PNEUMOCOCCIC CORNEAL ULCER HEALED IN 24 HOURS WITH PENICILLIN

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On March 22, 1946, Mrs. B., aged 62 years, was brought to me for examination. She was suffering from an ulcer in the left eye, which covered one fourth of the cornea, spreading from the 11- to the 3-o'clock positions. The ulcer had as an upper limit the sclero corneal limbus, and as a lower limit, a line with downward convexity near the center of the cornea.

The surface of the ulcer was irregular. It was covered with a grayish-white agglomeration and was eaten into. The edges were detached in places. Spreading in the lower-central dial from the 9- to the 6-o'clock positions and toward the center was a desquamated surface which penetrated deeply into the very tissue of the cornea. The remainder of the cornea was swollen with infiltrations.

In the lower part of the anterior chamber, there was a hypopyon $1\frac{1}{2}$ to $2\frac{1}{2}$ mm. high. The liquid in the anterior chamber was cloudy. The pupil was diminished. Chemosis and edema of the upper lid were present, as were intense perikeratic congestion, pain, tears, and photophobia. Under atropine dilatation, posterior adherences could be detected at the 9- and 2-o'clock positions. Precipitations on the anterior crystalloid could also be seen. The eyelid remained contracted in a spasm. Vision in the left eye was diminished to the perception of hand movements.

In the inner angle of the eye, on the skin of the upper lid, and at the base of the nose, there were four groups of pus eruptions. There was folliculitis in both nostrils, as well as an ulcerated area, and thickening of the nostrils with cracks in the skin. Microscopic examination of the pus showed the presence of pneumococci.

History. In the beginning of her affection, the patient had had a suppurative infection of the nostrils. About a month before she was brought to me for examination, she began to feel prickings and pains in the diseased eye. For two weeks, the patient's eye was treated with instillations and various unguents by an ophthalmologist in Sibiu. Later, she was advised to seek treatment in Bucharest.

Treatment. After anesthetizing the eye with cocaine, I irradiated the ulcer with the platinum needle. The eye was then dressed with methylene blue of Blaché. I advised the patient's son that the only hope of saving the eye was in treatment with penicillin.

After almost unsurmountable difficulties, the son was able to purchase a phial of 100,000 units of penicillin which he brought to me on March 23rd. I started immediate treatment with sodium penicillin. Into the phial, I injected 10 cc. of a 0.75-percent sodium-chloride solution. This sodium penicillin was administered as follows: (1) 10,000 units were embodied in 4 gm. of lanolin and applied under the patient's eyelid every hour for the first day. (2) 30,000 units were injected under the bulbar conjunctiva around the cornea in six successive doses of 5,000 units every four hours. (3) 60,000 units were given intramuscularly (10,000 units every four hours, six times).

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The conjunctival and intramuscular injections were administered at the same time. This treatment lasted for only 24 hours. For the next 24 hours, the penicillin unguent was applied to the eye every three hours.

Outcome. Three hours after the first conjunctival and intramuscular injections, the edema and chemosis of the eyelids had almost disappeared. The pustules and the nasal folliculitis had also begun to clear. Six hours after the first injection, the ulcer began to recede. The marginal zone around the ulcer (approximately 1 mm. wide) and the desquamated area no longer stained with fluorescein. The hypopyon was reduced to a trace.

After the third injection, the hypopyon disappeared completely. Spreading from the edge of the cornea like a pannus was a ramification of newly formed blood vessels. The corneal edema had disappeared, and the only posterior adherence was at the 9-o'clock position.

After the sixth injection, the ulcer was completely covered with newly formed blood vessels. The only congestion remaining in the eyeball was in the regions where the penicillin had been injected. The anterior chamber was clear, and the precipitants from the crystalloid had almost disappeared. Vision in this eye was now $1/6$. An infiltration zone remained at the 9-o'clock position but, according to the patient, this was an old spot. She said that she could now see as well as she ever had with this eye. All the pain was gone, and there was no longer any edema of the lids.

At the end of 48 hours, I observed that the congestion of the eyeball continued to reduce and that everything was progressing toward normalcy. The ulcer was still covered with a network of newly formed blood vessels which had begun

to retreat from the edge, leaving the cornea quite transparent.

Conclusions. The healing of a serious case of ulcer of the cornea in a 62-year-old woman—an ulcer which was approaching the abscess stage—was accomplished in 24 hours. The success of the penicillin treatment in this case is very impressive.

My first information on the treatment of such cases with penicillin was obtained through the American Library in Bucharest and especially from articles published in the *Ophthalmology Newsletter*.¹⁻³

In La Rocca's article,³ the quantities of penicillin used were about one tenth the amounts administered in this case. I was prompted to increase the doses because of the uncertainty of the effectiveness of the substance used. Although the label on the phial said that the penicillin was good to June 26, 1946, it also said that it should be kept at a temperature not exceeding 10°C. Since the penicillin had undoubtedly been handled by a number of black-market operators, one could be certain that this recommendation had not been observed. That is the first reason why the dosage was increased 10 times.

The second reason for the increase was to prevent the microbes from accommodating themselves to small quantities of the penicillin.

This communication is an attempt to aid in perfecting the treatment of ocular infections. The rapidity of cure in this case by administering penicillin in the very center of the infection indicates that the method is effective. Unfortunately, the lack of penicillin and its high price in our country make its use in ocular therapy an unusual event.

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PENICILLIN TREATMENT OF EYELID INFECTIONS

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Numerous articles have appeared in the literature during the past two years relating the results of treatment of infections of the eyelids, conjunctiva, and cornea with penicillin. For the most part, these results have been very favorable, and many cures have been reported. Especially favorable results were reported by Florey, McFarlan, and Mann,¹ who treated 48 cases of marginal blepharitis, 39 of which showed staphylococcus aureus on culture, by the application of penicillin ointment containing 600 to 800 units per gm. to the lid margins, three times a day. In all except one case, symptoms were alleviated, and 36 cases showed clinical recovery after three to six weeks of treatment and one year of observation. Bellows² reported excellent results with penicillin drops and ointment treatment of acute and chronic staphylococcal conjunctivitis. Stein³ reported excellent results in blepharitis with penicillin ointment.

Unfavorable results have also been reported in the literature. Several authors (Vorisek and Evans,⁴ Selinger,⁵ Schultz,⁶

Pyle and Rattner,⁷ Bellows⁸) have reported allergic reactions to penicillin used locally in the eyes.

Since November, 1944, 55 cases of acute and chronic eyelid and conjunctival infections have been treated by us with penicillin used locally in the form of drops, 2,500 units per cc. in normal saline solution, as well as in the form of ointment, 1,000 units per gm. The ointment was prepared by dissolving the penicillin in a small amount of distilled water and mixing it with amber petrolatum. Wool fat or similar substances were not used. The cases in which conjunctivitis was the principal finding were treated by drops; those having a blepharitis, mainly by ointment; and those showing a blepharoconjunctivitis, by a combination of ointment and drops. The drops were used every hour during the day and also once or twice during the night. The ointment was used on the lid margins, three times a day. Several cases of acute meibomitis received, in addition to the application of ointment, hot compresses for 20 minutes, 3 times a day. The periods of observation varied from a week to 18 months.

The cases were classified as follows:

	Cases
Blepharitis, chronic	3
Conjunctivitis, chronic	17
Conjunctivitis, acute	10
Blepharitis and conjunctivitis	19
Meibomitis, acute	6

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Cultures on blood-agar plates were made in all cases except those in the acute meibomitis group. In the blepharitis cases, the cultures were taken from the lid margins just behind the lash line, after expression of the meibomian glands. In the conjunctivitis cases, cultures were taken from the lower palpebral conjunctiva.

RESULTS OF TREATMENT

Blepharitis cases. Of the three cases in this group, two with negative cultures developed marked dermatitis of the lids after treatment for five days and were unimproved. One case with a pure culture of hemolytic Staph. aureus was markedly improved after four weeks.

Chronic conjunctivitis cases. Eight of the 17 cases in this group were cured within one week. Of these eight patients, three had negative cultures; one showed nonhemolytic Staph. aureus; three showed hemolytic Staph. aureus; and one showed Strep. viridans.

Three of the patients were well in two weeks. Two of these showed hemolytic Staph. aureus; the culture of the other was negative. Four cases were improved after two weeks. Two of these showed hemolytic Staph. aureus, and two, negative cultures. Two were unimproved. One of these showed nonhemolytic Staph. aureus and one Strep. viridans.

Acute conjunctivitis cases. Six of the 10 patients in this group were well in one week. Four of these had negative cultures; one showed both hemolytic and nonhemolytic staphylococci, and one showed hemolytic staphylococci. One developed lid dermatitis.

Two patients, both of whom showed negative cultures, were well in two weeks. One was improved after two weeks; his culture was negative, but lid dermatitis occurred. In one case, there was no improvement after three weeks. The culture

showed hemolytic Staph. aureus. This case also developed a lid dermatitis which disappeared after penicillin was discontinued.

Recurrent blepharitis and conjunctivitis cases. Of the 14 cases in this group, three were well in two weeks. The cultures showed hemolytic Staph. aureus in one case and were negative in two. Four cases were improved in one week. Three of these showed hemolytic Staph. aureus. All four recurred later and were again improved by penicillin treatment.

Five cases were improved in two weeks. Two of these showed mixed cultures of hemolytic and nonhemolytic Staph. aureus; one showed nonhemolytic Staph. aureus; one showed hemolytic Staph. aureus; and the culture of one showed no growth.

Two cases were unimproved. One showed a mixed culture of hemolytic and nonhemolytic staphylococci; in the other, the culture showed no growth. Both of these patients developed a lid dermatitis while under treatment.

Chronic blepharitis and conjunctivitis cases. There were five cases in this group, two of which were cured in one week. The cultures showed hemolytic Staph. aureus. Two others were improved in two weeks. One of these showed hemolytic Staph. aureus, and the other nonhemolytic Staph. albus.

One case was unimproved after four weeks. The culture showed hemolytic Staph. aureus. Lid dermatitis developed.

Acute meibomitis cases. Four of the six patients in this group were cured in one week. One of these developed a lid dermatitis several days after treatment was discontinued. Two were improved in two weeks, but the usual chalazion remained.

COMMENT

Nine of the 55 cases treated developed

TABLE 1

RESULTS OF PENICILLIN TREATMENT IN 55 CASES OF EYELID AND CONJUNCTIVAL INFECTIONS

	Cured 1 wk.	Cured 2 wks.	Impr. 1 wk.	Impr. 2 wks.	Impr. 4 wks.	Unim- proved
Blepharitis, Chronic					1	2**
Conjunctivitis, Chronic	8	3		4		2
Conjunctivitis, Acute	6*	2		1*		1*
Recurrent Blepharitis and Conjunctivitis		3	4	5		2**
Chronic Blepharitis and Conjunctivitis	2			2		1*
Acute Meibomitis	4*			2		-
Totals	20	8	4	14	1	8

* Each asterisk equals one case of lid dermatitis.

allergic dermatitis of the lids. This is a higher incidence than is shown in ordinary drug sensitivity. Since normal saline solution and amber petrolatum were used as vehicles, the penicillin must have been the allergin. All cases of dermatitis recovered when penicillin treatment was stopped.

The cultures in these cases showed only staphylococci and streptococci. There were no pneumococci or influenza bacilli reported, although cultures were taken on blood agar. This suggests the possibility of laboratory errors.

The cured cases were in a mixed group, as far as cultures were concerned. Some showed negative cultures, and several of those showing hemolytic *Staph. aureus*

were not cured. Spontaneous cures must be considered.

Herpetic keratitis developed in two cases during penicillin therapy.

SUMMARY AND CONCLUSIONS

The results of treatment of 55 cases of conjunctival and eyelid infections with penicillin were tabulated.

Allergic dermatitis was noted in 16 percent of the cases.

The results for the group as a whole were not superior to those shown by other forms of therapy. In a few individual cases, however, the results were remarkable.

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SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

April 1, 1946

DR. MAURICE L. WIESELTHIER, *presiding*

This meeting, the annual round-table discussion, was devoted to a single subject, "Complications of Ocular Surgery." Questions submitted before the meeting were edited and divided among the following ophthalmologists who comprised the panel of experts: Dr. Conrad Berens, Dr. Paul A. Chandler, Dr. John H. Dunnington, and Dr. Daniel B. Kirby. The interrogator was Dr. Isadore Givner.

PROPHYLAXIS AND THERAPEUSIS OF WOUND INFECTION

DR. CONRAD BERENS. The postoperative cataract wound may be infected from the air, conjunctiva, instruments, hands, or upper respiratory tract of the surgeon, assistants, and observers. The use of 1-percent silver nitrate preoperatively showed, in a study of 1,000 cataract extractions, suppuration in only one case. It is probably too early to say whether penicillin or sulfathiazole ointments are more efficacious than silver nitrate instilled two hours preoperatively, plus 25-percent argyrol at operation.

Conjunctival smears and cultures are taken a week before operation and, if pathogens are found, appropriate treatment is instituted. Lacrimal-sac infection should be treated, or dacryocystectomy or dacryocystorhinostomy performed. If infection persists, the puncta should be obliterated before operating. When bacteria are present in the eye and nose, they are often of the same type and toxicity. Nasal

and nasopharyngeal cultures have indicated unsuspected sinusitis. The conjunctiva may be secondarily infected from the nose and sinuses.

The surgeon and others in the operating room wear masks covering the nose and mouth. Thin rubber gloves minimize infection from the surgeon's hands. A narrow, complete conjunctival flap, carefully sutured, is most important in preventing infection. Instruments are preferably dry sterilized. Some surgeons immerse them in boiling water before introduction into the anterior chamber. A further precaution is to place instruments, sutures, and certain dressings in a 1:3,000 aqueous solution of zephiran.

Penicillin and sulfa drugs pre- and postoperatively seem to prevent certain low-grade postoperative infections, and the benefits resulting from their use as prophylactics outweigh their disadvantages.

If the anterior chamber becomes infected, wash it out immediately with penicillin. Administer penicillin intravenously in addition to appropriate sulfonamide and foreign-protein therapy. Penicillin should also be applied in conjunctival packs and by iontophoresis. Inject penicillin into the vitreous if it becomes infected by pneumococci or staphylococci. If a coliform organism is the offender, streptomycin is injected intramuscularly and perhaps locally.

TREATMENT OF EARLY POSTOPERATIVE INTRAOCULAR INFECTION

DR. JOHN H. DUNNINGTON. Most postoperative infections are due to staphylococcus aureus. Very little of any antibiotic agent applied locally, either in solution or ointment, penetrates into the

cornea and practically none into the aqueous. For effective penicillin treatment more energetic methods must be employed: (1) The eyecup, described by Struble and Bellows, through which solution can be introduced, should be applied for 30 minutes four times a day. (2) A cotton pledget saturated with penicillin (10,000 units per c.c.) should be placed in the cul-de-sac for an hour. (3) Subconjunctival injections of penicillin (2,500 units per c.c.) in novocaine or following novocaine injection give some bacteriostatic action to the aqueous. (4) Iontophoretic application of penicillin (2,500 units per c.c.) for two minutes gives the highest aqueous concentration of any of these methods. Usually 20,000 units of penicillin is also given systematically every three hours, combined with sulfadiazine, although very little of this penetrates into the ocular structures. Foreign-protein therapy probably enhances the effect of these treatments. Dr. Dunnington prefers these methods to direct injection into the anterior chamber. Vitreous injections, reserved for definite posterior infections, are not classified as early infection.

VITREOUS PRESENTATION OR LOSS IN CATARACT EXTRACTION

DR. DANIEL B. KIRBY. Presumably all precautions have been taken to avoid this complication. The loss of fluid vitreous offers less of a technical problem than normal or viscid vitreous because the eye will heal more gracefully if the cataract is extracted in capsule without undue trauma. Extracapsular extraction is difficult because the hypotony renders pressure ineffective and contraindicated because these eyes react badly to cortical remnants. Intracapsular extraction is feasible by traction, rotation, and if need be, stripping of the zonule. Accurate closure with appositional corneoscleral

sutures is important. A bubble of air or saline may replace some of the intraocular fluid.

Viscid or normal gel vitreous is more important and dangerous. If the vitreous is in the anterior chamber or in front of the lens, loop extraction is indicated because the vitreous interferes with placement of the forceps or suction cup. Place the loop carefully behind the lens to minimize vitreous loss and prevent dislodging the lens into the vitreous by other manipulation. If the vitreous is alongside the lens, forceps or suction cup may be employed. A wide iridectomy lessens the usual drawing up of the iris.

Prolapse or loss of viscid vitreous after the extraction is less serious when the intracapsular, rather than the extracapsular, method is used. Pressure is removed and the eye closed for several minutes; then cut away protruding vitreous and close accurately with corneoscleral sutures. If an iridectomy is possible and has not yet been done, do it, reposit the pillars, inject air or saline, and raise the head to help prevent iris incarceration. This careful toilet may salvage the eye; whereas, hurried backing out invites infection and poor healing with other complications.

TREATMENT FOR A FLAT ANTERIOR CHAMBER WITH SEPARATION OF THE CHOROID

DR. PAUL A. CHANDLER. Since corneoscleral sutures have been used, this has been a rare complication after cataract extraction. If it occurs and the anterior chamber is flat for an extended period, there is potential danger from peripheral anterior synechiae and glaucoma. Therefore, watchful waiting should not be employed too long, and interference is probably advisable during the second postoperative week. In two cases, the anterior chamber had been filled with air through a small puncture over the iris. When the

air was absorbed, the anterior chamber remained formed and the separated choroid had disappeared. This discussion applies, of course, only to cases without an obvious leak.

Selection of the filtration operation will to some extent avoid flat chamber. In older patients with a very thin, friable conjunctiva, there is greater likelihood of the anterior chamber remaining flat after a trephining operation than after iris inclusion. Dr. Chandler has not seen this complication persist more than a week after iris inclusion. It is safe to permit the anterior chamber to remain flat for a long period after trephination if there is free filtration. If filtration becomes less or disappears, the anterior chamber should not be permitted to remain flat too long. He has interfered in only two of these cases. In one, after a month, a sclerotomy over the separated choroid was performed with a cataract knife. The anterior chamber formed while the patient was on the operating table and in 3 to 4 days the choroid was back in place. In the other, after a similar sclerotomy, the anterior chamber was formed at once, but the choroid did not go back. If there is not free filtration, Dr. Chandler is inclined to do such a sclerotomy early, for it is safe and simple.

ATTEMPTED INTRACAPSULAR EXTRACTION THROUGH A ROUND PUPIL WHEN THE CAPSULE RUPTURES

DR. DANIEL B. KIRBY. The fragility of the capsule varies. If the forceps slip off without rupturing it, the area of application has been weakened and the next grasp should be elsewhere. A small tear can be straddled with the forceps. In larger tears above, Dr. Kirby has applied the forceps near the lower pole, tumbling the lens out in capsule. He has also slipped a second pair of intracapsular forceps held in the right hand over the torn edge

of the capsule and, with alternate traction on both forceps, removed the capsule and its contents.

If the capsule edges are not easily visible with the loupe and if the lens is less than half out, use toothed forceps, remove a large piece of capsule and perform a capsulotomy extraction.

It may be possible and desirable to remove the loose capsule after the cortex and nucleus are out. The capsule may be grasped with intracapsular forceps, drawn out a little, grasped below with other forceps, and so be gradually removed even when sufficiently fragile so that one forceps used alone would tear it. In some cases with relaxed vitreous, it is justifiable to lift the corneal flap and pick up the loose capsule.

If the posterior capsule is intact, it is feasible to irrigate away loose cortex. After all the capsule has been removed, the conservative closure of such eyes without risky manipulation is justified in order to prevent injury to the hyaloid and vitreous prolapse. Complete iridectomy depends on whether the lens cortex and nucleus are easily delivered without a coloboma. Postoperatively a round pupil is the more desirable, but the reaction of the eye may be less with an iridectomy.

IRIS PROLAPSE AND ITS TREATMENT AFTER CATARACT EXTRACTION

DR. JOHN H. DUNNINGTON. The incidence of this complication is reduced by careful wound closure. If it occurs, the general rule should be prompt excision. If more than 12 hours elapse after its appearance, a freeing of the iris is difficult. Dr. Dunnington has not had success with replacing the iris without excision, nor have such cauterizing agents as trichloracetic acid been successful. The only condition in which a decision between noninterference and excision may be difficult is when there is a small pro-

lapse completely covered by conjunctiva. He believes these should be excised as they have a tendency to enlarge. If the patient is too tense or the eye too tender for local anesthesia, pentothal sodium is very satisfactory. There is no material difference in the management regardless of the time of its appearance.

COMPLICATIONS ATTRIBUTABLE TO KEEPING PATIENTS ABED POSTOPERATIVELY

DR. CONRAD BERENS. Two patients developed hypostatic pneumonia after cataract extraction, probably the result of a long stay in bed. Severe constipation and gastro-intestinal disturbances have been common, but they can usually be controlled by colonic therapy if the usual methods for relief fail. Long bed rest with both eyes covered induces severe psychic disturbances in some patients. Nervous patients should have the unoperated eye opened the day of the cataract extraction and in 2 or 3 days following operations for detachment of the retina. The patient is propped up 30 degrees as soon as possible after operation for cataract, glaucoma, and detachment of the retina if the detachment is below. If the detachment is above, the patient is kept flat. If the cataract wound is sutured sufficiently well, Dr. Berens has permitted patients out of bed the same day, although the sedation and nerve shock make it preferable to wait until the next day. Only detachment patients are not permitted out of bed on the same or first postoperative day. They are usually kept in bed for two weeks, although certain experiences have made him question this practice. The first patient he operated on in 1930 after returning from Gonin's clinic sat up in a chair after five days because the operation seemed a failure, but later there was a complete reattachment. Two of his most unruly and restless patients have had satisfactory results.

OPERATION FOR CHRONIC SIMPLE GLAUCOMA COMPLICATED BY CATARACT

DR. PAUL A. CHANDLER. One must decide in each case whether the cataract or the glaucoma is primary. If the glaucoma is serious and the cataract not advanced, the operation is chosen on the same basis as if there was no cataract. In patients past the middle sixties, the glaucoma is very often secondary to cataract, particularly if the anterior chamber is shallow. If the cataract is nearly mature to hypermature and if the tension can be brought to reasonable limits with miotics, Dr. Chandler prefers intracapsular extraction with a broad basal iridectomy. He hesitates to do a glaucoma operation to be followed shortly after by lens extraction in these cases. The lens can be extracted successfully, but occasionally, despite careful placement of the cataract section so as not to disturb the filtering scar, it will cease to function after cataract operation.

LENS SUBLUXATION OR DISLOCATION INTO THE VITREOUS AFTER A CATARACT INCISION

DR. DANIEL B. KIRBY. A distinction must be made between cases with fluid and viscid vitreous. If preliminary examination discloses subluxation and fluid or semifluid vitreous when the section is made, the vitreous will seep away and the lens will sink. It is safe to place sclerocorneal sutures after the section. Outside pressure is ineffective, and the lens should be removed by traction with forceps. When the lens subluxates upward, Dr. Kirby recommends passing a loop down over the face of the lens and rotating it in its long axis through the break in the zonule to come up under the lens. The loop supports the lens while intracapsular forceps are placed on the capsule to draw the lens down and hold it while the loop is maneuvered to strip off the remaining zonule if necessary. The typical passage

of the loop through the upper intact zonule would risk luxation of the lens into the fluid vitreous.

If, before or during the operation, the lens is found luxated completely into fluid vitreous, then Verhoeff's technique of irrigation of the vitreous chamber, floating the lens to lift it out with a loop, appears useful. A lens adherent to the retina or ciliary body is best left alone as the eye will better tolerate the condition than the interference. Try coaxing the lens through a dilated pupil by the prone position, and then imprison it with a miotic for immediate removal.

With viscid vitreous, use preplaced sutures. If the intraocular pressure is increased, posterior drainage of the vitreous to relieve the pressure may give fewer complications than uncontrolled loss of vitreous anteriorly. A complete iridectomy minimizes updrawing of the pupil. After the aqueous escapes, the vitreous comes forward and brings the lens forward with it. The loop is passed through the zonular hiatus and a trial of traction alone is made. Pressure on the cornea is seldom necessary. Forceps support the lens while the loop strips off the zonule, sweeping around the equator where the zonule is adherent. In some cases, forceps cannot be placed on the capsule because of overlying vitreous.

A lens luxated into viscid vitreous is best visualized with ultraviolet light and its mobility tested by moving the patient. The interference and resistance of the vitreous makes it unlikely that it can be brought into the anterior chamber. If the lens remains in the viscid vitreous, it will cause degeneration and fluidification and its removal is simpler, although the prognosis is grave.

DELAYED RESTORATION OF THE ANTERIOR CHAMBER

DR. JOHN H. DUNNINGTON. Prophylactic treatment of delayed restoration of

the anterior chamber consists of accurate wound closure plus careful wound toilet. In round pupil extraction, the iris may be a causing factor, and eserine may possibly be a help as a postoperative measure. The corneoscleral suture is valuable if properly applied, but otherwise it is worse than none. The introduction of air after cataract extraction has lessened the incidence of this complication. Absence of the anterior chamber means a leaking wound calling for location and closure of the leak. A conjunctival flap generally is insufficient to close the wound. In addition, place a suture through the lips of the opening to approximate the edges. Any epithelium about the opening should be cauterized before placing the sutures.

Complications following delayed restoration of the anterior chamber are: (1) detachment of the choroid; (2) total or partial peripheral synechia; (3) adherence of the iris to the face of the vitreous; (4) there may develop adhesion between vitreous and cornea producing deep corneal opacity; (5) if the delayed restoration has followed a glaucoma operation, cataract may follow; (6) formation of a vascular membrane on the posterior surface of the cornea; (7) epithelialization of the anterior chamber; (8) glaucoma.

HYPOTONY AFTER A FILTERING OPERATION

DR. PAUL A. CHANDLER. Two points especially have a bearing: (1) A very thin conjunctiva. (2) The absence of postoperative inflammation. If, at operation, manipulation of the conjunctiva shows it is thick and strong, hypotony will seldom develop. With a very thin and delicate conjunctiva, and this is especially true of older people, it is easy to get filtration; and if a 2-mm. trephining operation is done, a soft eye will often follow. Therefore, iris inclusion, rather than trephination, is the operation of choice in older individuals with thin conjunctivas. The softest eyes are those which remain white

and quiet postoperatively. If the postoperative reaction of an eye could be predicted, one would perform an operation giving freer filtration, such as a trephination, where a stormy convalescence is anticipated; and a less extensive procedure, as iris inclusion, for little postoperative reaction. If during preparation for operation and the operation itself, the eye becomes more or less congested, one would expect a greater postoperative reaction and vice versa, but Dr. Chandler is not sure whether this is a reliable test.

For obvious leakage of the bleb, a conjunctival flap is drawn down over the opening after cauterizing the cornea around the bleb. Cauterization of the surface of the bleb may have no effect in some cases; while in other cases, if more extensive, may entirely stop filtration. Where there is no obvious leak, Dr. Chandler uses only a mild antiseptic to ward off infection. In younger patients with very soft eyes after filtering operations, one is at least sure the glaucoma is arrested. Often, after a year or two, the tension rises to reasonable levels. Post-hypotony cataract can be removed with less likelihood of recurrence of the glaucoma than if the filtration were barely adequate before extraction of the lens.

REOPERATION AFTER AN UNSUCCESSFUL OR INADEQUATE MUSCLE OPERATION

DR. CONRAD BERENS. This depends upon the type of operation and what it was designed to correct, the patient's age and health, and many other conditions. Specifically, if a patient has had an operation upon one lateral rectus in exotropia at 6 meters with little convergence insufficiency, he may have an operation within a month on the other eye for residual exotropia of 10 degrees or more. In divergence insufficiency with a resection of one lateral rectus muscle, resect the other lateral rectus after a month. If both lateral recti had been operated

upon, wait four months before reoperating. In convergence insufficiency after operating on one medial rectus, should there be a high residual deviation at the near point, do not hesitate to operate within two months on the other medial rectus unless the patient responds unusually well to convergence exercises. However, in convergence insufficiency any indicated general treatment and converging exercises should be given a thorough trial before operation. In convergence excess, especially in young children, wait three or four months after a recession on one medial rectus before operating on the other medial rectus. If both medial recti had been operated upon, wait six months before operating. In hypertropia due to weakness of one superior rectus with overaction of the inferior oblique of the other eye, if a marked hypertropia persists despite an operation on the inferior oblique, after two months consider resecting the weak superior rectus. If the patient fixes with the eye with the paretic superior rectus, vertical deviations caused by spasm of an inferior oblique tend to increase. If the vertical deviation is not stabilized, consider myotomy at the orbital insertion. Secondary cicatricial divergent strabismus after retroplacement or recession of a medial rectus is corrected by resection, advancement, and Tenon's capsule transplantation of the involved muscle after at least three months.

CHOROIDAL DETACHMENT AFTER INTRA-OCULAR SURGERY

DR. CONRAD BERENS. Detachments of the choroid following cataract extraction may occur at or immediately after operation. Dr. Berens has never operated for this type of detachment which O'Brien says occurs after practically every cataract extraction. An almost complete choroidal detachment after a glaucoma operation subsided rapidly leaving no observable ophthalmoscopic signs. If the wound heals

completely or filtration diminishes rapidly, the detachment usually heals spontaneously and requires no special treatment. These patients are permitted to be up as soon as any cataract patient. With postoperative detachment persisting longer than six weeks, consider an electrolysis puncture or a simple scleral puncture. Delayed detachments occurring months or years later may be caused by reopening of the wound or possibly by lowered intraocular pressure from other causes.

When a filtering wound has leaked as shown by fluorescein and application of trichloroacetic acid has not proved effective, Tenon's capsule has been successfully transplanted under the conjunctiva.

HANDLING OF EXPULSIVE HEMORRHAGE

DR. DANIEL B. KIRBY. Know the patient's cardio-vascular system before operation. If the systolic pressure is high, sedation and rest in bed preliminary to operation are good. If the patient is plethoric, venesection may help. If the diastolic pressure is 120 mm. Hg., there is apt to be turgescence of the choroid, presentation of vitreous, if not intraocular hemorrhage and expulsive hemorrhage. The whole mechanism also depends on how the blood vessels withstand the blood pressure and the lowering of the intraocular pressure by the incision.

Inject crude liver if the red blood cells are not normal; inject ascorbic acid, in addition to prescribing fruit juice by mouth, for its effect on the blood vessels. The patients need milk or calcium. The bleeding and coagulation time does not indicate the degree of bleeding at the time of surgery. Inject vitamin K for abnormal platelet count or prothrombin time, using care in elderly patients who may develop a thrombosis, if the action is too great, and in the patient predisposed to thrombosis.

It is best to postpone surgery for serious orbital hemorrhage after retrobulbar

injection. If expulsive hemorrhage occurs once the section has been made, put on pressure and trust the hemorrhage will stop. All one can do is to explain the situation and advise enucleation as soon as feasible.

POSTOPERATIVE HYPHEMIA AND INTRA-OCULAR HEMORRHAGE

DR. JOHN H. DUNNINGTON. Treatment for postoperative hyphemia is simple: bed rest, eye rest, watchful waiting, and no heat. If the tension is increased or the anterior chamber is filled with black blood showing no tendency to absorb, a paracentesis for removal of the blood clot is in order.

Proper placing of the incision is most important in controlling intraocular hemorrhage. A deep section is the usual cause of blood filling the anterior chamber. Should such an occurrence take place, wait until bleeding is stopped, remove the clot, and then proceed with the extraction. In a patient with high ocular tension, try to avoid sudden reduction of pressure by retrobulbar injection. If tension remains high, reduce it by very slow evacuation of the anterior chamber. Arterial tension does not seem to have anything to do with hemorrhage at the time of operation. If the iris is vascularized and the cataract is complicated, select the site of the iridectomy carefully to avoid blood vessels. If bleeding occurs at time of operation, wait until a clot forms before performing the extraction.

REOPERATION IN ACUTE AND CHRONIC SIMPLE GLAUCOMA

DR. PAUL A. CHANDLER. One may rarely see a case in which, a few hours after operation for acute glaucoma, the tension rises to an exceedingly high level, and something has to be done immediately. If operation for acute glaucoma fails to bring the tension to normal, there is usually no great urgency in doing the

second operation. It is best to wait until the eye becomes quiet or shows no further tendency toward becoming quiet. If the pressure is 30 to 39 mm. Hg., continue with miotics. Unless the field is exceptionally small or the tension is so high as to constitute a real danger, one can safely wait weeks before reoperating. If the tension is over 40 mm. Hg., one dare not wait long, as damage takes place more rapidly at these levels. In chronic simple glaucoma, follow somewhat the same rule. A guide is whether the patient can afford to sacrifice a little more vision and field while waiting for optimum conditions for reoperation. Chances for success in a second operation are better with a quiet eye, but if congestion persists there is no point in further delay.

Many of the reasons for failure of glaucoma operations are unknown, but one reason lies in the choice of operation. Iridectomy will not be sufficient in neglected primary acute glaucoma which does not respond to miotics. A filtering operation is required for this. Failures in chronic simple glaucoma may be due to errors in technique. In a trephining operation, if the trephine is slanted too much and less than two thirds of the corneoscleral button is loose when the anterior chamber is entered, it is difficult to remove the whole button with scissors. Once the trephine is applied accurately it should not be removed until it enters the anterior chamber. One may occasionally push the button into the anterior chamber, but no harm is done. A dull trephine blade adds greatly to the difficulties. In iris inclusion operations, a cause of failure is too much manipulation of the iris. The grasp of the iris must be gentle and not too wide, withdrawal should be very slow, and undue traction should be avoided. The cut should be made with very sharp scissors. Once the cuts are made, release the iris forceps immediately, and the operation is over.

Even though the iris is rolled up make no further manipulations. One of the greatest reasons for failure in all glaucoma operations, no matter how well executed, is marked postoperative inflammation. An eye remaining irritable with postoperative iritis for many weeks is very apt not to show good filtration. This is a real traumatic iritis. If a second operation is performed, everything possible should be done to eliminate foci of infection which might be factors in causing the iritis.

GLAUCOMA FOLLOWING CATARACT EXTRACTION

DR. CONRAD BERENS. If the glaucoma is caused by delayed reformation of the anterior chamber, it is justifiable to inject saline or air in an attempt to open the closure which causes difficulty. If the hypertension is caused by inflammation, Dr. Berens often injects typhoid-H. antigen intravenously, followed in 48 hours by aspiration of the anterior chamber. He frequently uses mild mydriatics and applies heat. Foci of infection are removed or resistance to them raised by vaccine therapy combined with penicillin, the sulfonamides, or other appropriate measures. If the hypertension is not marked or painful, he often aspirates. One patient's anterior chamber was aspirated 16 times before the tension was stabilized. In this patient, no chronic infection or other specific cause was found. Marked pain is sometimes relieved by injecting procaine and then alcohol through the same needle into the ciliary ganglion. If aspiration, washing out soft lens matter from the anterior chamber, repeated paracentesis, and local measures do not relieve the situation, the first choice of operation is cyclodialysis. In recent years, cyclodiathermy, or cyclo-electrolysis, has given excellent results, although in three cases the procedure had to be repeated below. If these measures do not succeed, Dr.

Berens usually incarcerates one pillar by performing a sclerectomy over one pillar subconjunctivally with a punch. If this does not stabilize tension, the other pillar is incarcerated. The final measure, which has been successful in some cases, is to perform a small trephining operation below.

GLAUCOMA APPEARING AFTER CATARACT EXTRACTION

DR. PAUL A. CHANDLER. Glaucoma appearing for the first time after extracapsular or linear extraction is not uncommon in cases in which a good deal of cortex is left. No treatment is required as long as the tension stays between 30 to 35 mm. Hg. If tension is higher and there is a large amount of cortex, it is probably best to remove some of the cortex. If there is very little cortical material, or if the extraction was intracapsular, then do nothing for the glaucoma, because in these cases the tension is usually transient and harmless. Much worry about glaucoma in the immediate postoperative period after intracapsular extraction can be avoided if the tension is not measured. When, three days after intracapsular extraction, a patient showed a hazy cornea and increased tension, nothing was done, and in two days the tension was normal. In a case in which there is marked increase in tension in the immediate postoperative period, a simple paracentesis would be the most drastic measure considered. For a theoretical choroidal hemorrhage which does not break the wound open but results in an exceedingly hard eye, one might do a scleral puncture over the area of the detached choroid.

GRASPING THE LENS CAPSULE FOR AN INTRACAPSULAR EXTRACTION

DR. DANIEL B. KIRBY. Grasping the capsule below the pupillary border is well illustrated in the Knapp operation in which the zonule is ruptured by traction,

and rotation and tumbling are started before pressure is applied. If the lower zonule always ruptured easily, this would be the best place for forceps application, but experience has shown that it is probably a better procedure to apply pressure simultaneously. The lack of transparency of the collapsed cornea is not too much of a handicap in placement of the forceps. The round pupil can be well preserved by this method. However, the degree of rotation and traction and the ability to lift the lower pole of the lens are limited by the relatively narrow and shallow anterior chamber. If forceps are not introduced carefully, the corneal endothelium may be injured. Lastly, it is not necessary to tumble all cataracts to protect the vitreous which, if properly handled, does not need protection. Vitreous loss is due to factors other than the method of delivery.

Dr. Kirby grasps the capsule above because it is more easily accessible, being directly visible when the corneal flap is elevated. This method gives the surgeon better control over his grasp of the capsule. Simultaneous pressure from below tilts the lens and permits straddling of the presenting adventitious equator. The round pupil can thus be preserved. There is greater possibility of traction and rotation with appreciation of the correct position for simultaneous pressure for greatest effect. The zonule may be seen during these maneuvers and its qualities assayed. If it is too resistant, then a dehiscence may be started by touching it at the point where it is put under tension and with such a hole begun in the zonule, tearing may be continued by traction and rotation, or the remainder of the zonule may be stripped off.

REOPERATION FOR RETINAL DETACHMENT

DR. JOHN H. DUNNINGTON. If the operation is not 100 percent successful, it

is not successful. A second operation for retinal detachment generally is not done in less than 3 to 4 weeks. If ocular tension is low and retinal detachment is not progressive, it is preferable to wait longer. On the other hand, if there is detachment with a hole not closed completely at the time of the first operation, do not delay unnecessarily. Wait only 3 to 4 weeks before going ahead with the second operation. The chances of success go down with each operation, although in one case success was achieved after four previous failures. Success resulted in 3 of 9 cases operated three times. In one patient, a successful operation was performed on her only eye after five previous operations. The condition of the eye, the extent of the detachment, and the tension of the eyeball should be the factors which determine whether to reoperate, rather than the number of previous operations.

GLAUCOMA OPERATIONS FOR NEGROES

DR. CONARD BERENS. The only operation with which Dr. Berens has had extensive experience is iridocorneosclerectomy. These wounds do not filter well and hypertension often recurs, even when combined with iridencleisis. He has used cyclodiathermy successfully several times. Cyclo-electrolysis has been used once, but the time since operation has been too short to judge the results.

HYPHEMIA AFTER GLAUCOMA OPERATIONS

The head and torso are kept elevated. In the early stages, cold compresses are applied, later these are followed by hot compresses, if tension is controlled. The anterior chamber is not irrigated, and Dr. Berens has not seen serious permanent complications. If the blood extends under the conjunctiva or is under pressure, irrigation of the anterior chamber might be advisable. Nothing used preoperatively or postoperatively has seemed to aid in

preventing hyphemia. If bleeding from the sclera or episcleral blood vessels persists at the time of operation, the actual cautery or electrodesiccation is applied. This type of hyphemia is not recurrent. In this respect it differs from the hyphemia which follows cataract extraction. In both types of hyphemia, the bleeding seems to be more from the sclera than from the iris.

Leon H. Ehrlich,
Secretary.

COLORADO OPHTHALMOLOGICAL SOCIETY

April 20, 1946

DR. GEORGE STINE, *presiding*

TUMOR OF CILIARY BODY

DR. WILLIAM M. BANE presented a man, aged 38 years, in whom, during a routine refraction, a symptomless, brown-gray spherical tumor of the ciliary body was found. It measured about 5 mm. in diameter and was attached at the 4- to the 6-o'clock position. It was easily seen through the dilated pupil, and its outline was well-shown by transillumination.

OPHTHALMIC SURGERY

As part of the annual Edward Jackson Memorial Lecture, Dr. Lawrence T. Post of St. Louis delivered an address on ophthalmic surgery in which he discussed the various details of surgical techniques used in his own work at Barnes Hospital in St. Louis. In cataract extractions, a preliminary complete physical examination including X-ray studies of teeth is insisted upon. If the blood pressure is above 200, every effort is made to reduce it, even to keeping the patient hospitalized for days or weeks before surgery. Each instrument used is dipped in zephiran

authorities. Never before has the Research Study Club had such an array of teaching talent, and the full attendance at every lecture and instruction course was a tribute of appreciation to the teaching staff.

Dr. Benedict gave a masterful treatise on diseases of the orbit. Of particular interest was Dr. Benedict's discussion of X-ray therapy for various conditions causing exophthalmos. He showed slides and moving pictures of cases of exophthalmos brought about by certain nonmalignant diseases of the orbit—Mikulicz's disease, lymphosarcoma, low-grade cellulitis, and special cases of exophthalmic goiter—which had responded successfully to X-ray therapy. The early treatment of malignant exophthalmos related to thyroid-pituitary imbalance, by using X rays on the globe, was particularly new. This treatment has met with fair success if instituted during the period of infiltration, before fibrous changes set in.

Dr. Wagener discussed retinal changes in relation to systemic disease. Sclerosis of retinal vessels is more an indication of the duration of hypertensive disease than of its severity; whereas, localized spastic constrictions are, in general, indicative of the severity. Exudative lesions depend on the degree of anoxemia, with subsequent edema and degeneration, as well as on the lack of absorption of end products. Thrombosis of a branch of a vein usually indicates a mild hypertension with chronic sclerosis of the vessel, and, from the standpoint of hypertension, the prognosis is good. The prognosis for vision is more favorable if there is early recanalization of the vessel. In certain of these cases the anticoagulants are indicated, particularly if the superior temporal vessel of an only eye is involved. Hemorrhages, edema, "cotton-wool" patches, appearing in the course of hypertension, signify beginning retinal-vascular decompensation.

The picture in glomerular nephritis is one of anemia with, in addition, vascular disease as sclerosis or spasm, the anemia being a distinguishing feature. In patients who have only a slight increase in blood pressure, albuminuria, and arteriolar sclerosis, as judged by the appearance of the retinal vessels, the condition is probably one of essential hypertension and not nephritis in about 90 percent of cases. A large percentage of nephritics show no sclerosis.

Speaking of toxic pregnancy, Dr. Wagener said that there is generalized and localized spasm of the retinal vessels. If this is not rapidly corrected by sedatives, the pregnancy should be terminated to avoid the onset of sclerosis which is irreversible. If one waits until retinopathy develops, the chance of obtaining a viable baby is extremely poor, and the chance of developing marked arteriosclerosis is great.

For Eale's disease Wagener believes that bedrest is the most important part of the treatment. Discussing temporal arteritis, he stated that the vision of 50 percent of all patients with this affection eventually becomes involved. Optic neuritis and occlusion of the central retinal artery are common complications. Recurrent spasms of the central artery or of branch arterioles may be allied to Raynaud's disease. It is probable that angioid streaks in the choroid are an expression of a generalized defect of elastic tissue in the blood vessels, as well as in the skin.

In diabetic retinopathy, Wagener feels that the early stages can be stopped or reversed if a careful diabetic regimen is instituted. He has seen "cotton-wool" patches disappear in diabetics after the clearing of an infection, such as carbuncle. The serum protein may be low in diabetes, the albumin-globulin ratio altered, and the blood cholesterol high. Retinal hemorrhages are less if these ab-

normal blood findings are corrected. X-ray therapy may promote absorption of blood from the vitreous, but has no effect on the proliferation of vessels.

The retinal hemorrhages in blood dyscrasias are a result of thrombocytopenia—not of hypoprothrombinemia (vitamin-K deficiency)—plus toxic damage to the capillary endothelium and venous stasis. The hemorrhage is usually massive and dense with white centers in leukemias. Spot hemorrhages that have white centers and regular borders are more characteristic of bacterial endocarditis; and those with irregular white centers and irregular borders more characteristic of blood dyscrasias.

Dr. Meyer Wiener gave a course in applied anatomy in eye surgery, in which he correlated many of the surgical tricks he has originated with the anatomy of the part involved. The course was fascinating because of the practical application Dr. Wiener has made of what might otherwise be abstract anatomic facts. In addition, he gave a lecture on his work with rehabilitation of the blind, outlining ways and means whereby these patients may be helped to live happy and useful lives.

In discussing cataract surgery, Dr. O'Brien stressed the value of the keratome incision; the importance of marking the limbus at the 12-o'clock position before starting the operation in order to orientate the position of the globe; the value of having the assistant apply counter pressure, above, on the scleral lip of the wound, as the lens is being tumbled; and the importance of having, in so far as possible, direct visualization of the lens as it is being grasped below with the forceps. He is able to observe the lens, as it is grasped, by elevating the flap with a suture which has a knot in one end to keep it from pulling through.

Dr. O'Brien also showed excellent slides and discussed both the history and

course of various types of ocular tumors.

Dr. Pischel discussed in great detail the diagnosis and treatment of retinal detachments. He stressed not only the importance of the patient's history but also the significance of the patient having noticed sudden showers of specks before the eyes, flashes of light, and a curtain effect blotting out part of the visual field. He said that he sometimes spends many hours searching for holes and that often these can be found only with maximum dilation of the pupil and with a brilliant, narrow, ophthalmoscopic beam shone to one side of the hole, so that it stands out by retroillumination. The position of the greatest degree of detachment does not necessarily indicate the position of the hole; since fluid gravitates down, the hole may be above. He favors the idea that most holes are the result of vitreous traction on the retina. In his studies of these cases with the Koeppel contact glass and the slitlamp, he has observed detachment of the vitreous with but a single point of attachment at the site of the tear.

Pischel feels that idiopathic detachments are frequently precipitated by minor jars or blows to the body that may be forgotten until recalled after searching questions and prolonged reflection on the part of the patient. Bumping the head, sitting down hard—such falls or jolts may be the precipitating factor in producing an idiopathic detachment. Approximately 25 percent of the patients suffering such detachments develop detachment in the other eye within five years, a fact stressing the importance of treatment of the original detachment.

There is no treatment other than surgery. Pischel advises preliminary immobilization of the eyes, in a position dependent upon the region of the detachment, to allow as much settling as possible before operation. The region of the tear is treated under direct ophthalmo-

scopic observation, using Pischel pins for localization and Pischel points for semi-perforating diathermy treatment. Dr. Pischel does not use galvanic current but has no objection to its use if combined with diathermy. He obtains about 80 percent cures in all detachments seen, and, in desperate cases, he does not hesitate to resort to Lindner's scleral shortening operation.

He feels that about 10 percent of detachments have a hole in the macular area that needs treating. If there is doubt about the presence of a hole, however, it is most likely absent, and the macular region need not be treated. Only in this respect do his ideas differ from those of the late Clifford Walker, who must be given credit for having practiced (many years before they were generally appreciated) the methods which today are considered the latest and best. Appreciation of this fact does not detract from credit due Pischel, whose work has been done independently and who popularized these concepts more than did Clifford Walker.

Dr. Harrington, in his discussion of tonometry, stressed the importance of taking tensions with two weights to determine the coefficient of rigidity of the cornea, as was advocated by Friedenwald. He feels that, in secondary glaucoma, rigidity of the corneoscleral coats of the eye is increased. This would account for an apparent increase in tension, which may not be real, and might explain the frequently observed fact that secondary glaucomas withstand tension better than primary glaucomas. Dr. Harrington is working on this problem and should soon have statistics important to an evaluation of this concept.

Dr. Swan, reporting on work for which a partial grant was given by the Research Study Club, discussed the use of new drugs in the treatment of external diseases. Apparently the Koch-Weeks, in-

fluenza, Morax-Axenfeld, pyocyaneous, and tuberculosis organisms are sensitive to streptomycin. However, these organisms become drug-resistant within a matter of a few hours. It is essential, therefore, that the initial dosage be maximal. For ocular conditions, systemic administration of 1 gm. a day, in addition to local application in the form of ointment (10,000 units per cc. for skin, and 5,000 per cc. for conjunctiva, every 2 or 3 hours); is used at present. The drug should be employed only in severe infections which fail to respond to other treatment, because 10 percent of the patients receiving streptomycin systemically develop irreversible damage to the eighth nerve. The earliest that damage has occurred in Swan's experience was after use of streptomycin for 16 days. Since most eye conditions respond in less time than this, he has not encountered deafness, resulting from the treatment with streptomycin, of any eye patient. Nevertheless, it is wise to depend primarily on local use of streptomycin whenever possible.

Regarding penicillin, in Swan's experience, 11 percent of the population became hypersensitive to penicillin after prolonged use, and so he advocates using it only in acute, not in chronic, processes. Penicillin can be very effectively introduced into the eye by iontophoresis, using 4-percent methocel in distilled water as the vehicle. Swan recommends a current of 1.5 milliamps for two minutes, the negative electrode being on the eye. This has been particularly effective for pneumococcus ulcers. By this method, the anterior chamber can be irrigated with penicillin, and penicillin can be injected into the vitreous if need be.

Swan feels that in those eye cases for which sulfonamides are indicated, for example in inclusion-body blenorrhea and trachoma, a blood concentration of 3 to 5 mg. percent is sufficient, and he recom-

mends sulfamerazine (2 gm. as an initial dose, and $\frac{1}{2}$ gm. every 8 hours thereafter) to keep the blood concentration at the desired level. Sulfamerazine stays in the blood longer than sulfadiazine and penetrates the ocular tissues with more facility. Swan's experience with pyribenzamine, in controlling allergic conditions, has been favorable.

As usual, the California weather was sunny, the atmospheric radioactivity therefrom contributing to the physical well-being of the guests, while the local ophthalmologists extended hospitality and entertainment typical of Los Angeles and not available elsewhere.

S. Rodman Irvine.

WISDOM FROM THE PAST

One hundred years ago the first American edition of Lawrence's *A Treatise of the Diseases of the Eye*, edited by Isaac Hays, M.D., of the Wills's Hospital, Philadelphia, was published by Lea and Blanchard of Philadelphia. Lawrence's *Treatise* was first published in England in 1833, and a second edition appeared in 1840. It was an informative, mature study of diseases of the eye according to the knowledge of those days, and was very popular with the practitioners. It makes fascinating reading today, for it is filled with wisdom and timeless advice.

The following excerpt from the introduction by Lawrence is as timely today as it was 100 years ago and is reproduced here to express our philosophy of modern ophthalmology.

"It is hardly necessary to enlarge on the importance of the subject, or to prove formally that a knowledge of it is indispensable to medical practitioners. Everyone feels that sight is the most valuable of the senses; that it not only is, in itself, the most important inlet of knowledge, the most valuable medium of our communi-

cation with surrounding persons and objects, but also that it is essential to the full enjoyment of our other senses; to the free exercise of almost all our other faculties and endowments; so that these lose more than half their value when sight is gone. Hence blindness is one of the greatest calamities that can befall human nature, short of death; and some would perhaps prefer the termination of existence to its continuance in the solitary and dependent state, to which life is reduced by the privation of this precious sense.

"Loss of sight is the greatest misfortune even to the rich, who can alleviate it by purchasing the aid and services of others. How much more severely must it be felt by the poor, by the middle and lower classes of society, that is, by the great majority of mankind; who, being rendered incapable of labor, and having their minds uncultivated, find their existence reduced to a dreary blank, dark, solitary, and cheerless, burdensome to themselves and to those around them. Even our great poet, who might have been supposed to find every alleviation and resource that such an affliction admits of in his highly-gifted mind, and the exhaustless stores of knowledge with which it was furnished, repeatedly reverts to his blindness, and always in a tone of anguish and despondency characteristic of recent misfortune:

"Thus with the year
Seasons return; but not to me returns
Day, or the sweet approach of eve or
morn,
Or sight of vernal bloom, or summer's
rose,
Or flocks, or herds, or human face divine;
But cloud instead, and ever-during dark
Surround me from the cheerful ways of
men
Cut off, and for the book of knowledge
fair

Presented with a universal blank
 Of Nature's works, to me expunged and
 rased,
 And wisdom at one entrance quite shut
 out.'

"It often depends on the surgeon whether the patient shall retain or lose, recover or remain bereft of vision. Common external inflammation of the eye, if neglected or improperly treated, by rendering the transparent anterior portion of the organ more or less opaque, proportionally injures vision; inflammation of the iris, when unchecked, causes contraction of the pupil and effusion of lymph, which prevents the passage of light into the eye. Affection of the nervous structure, if not arrested in its beginning, terminates inevitably in diminution or loss of sight. Such distressing results have too often been promoted by modes of treatment, in favor of which the sanction of names that have enjoyed public confidence might be adduced. The success of operations for cataract, or artificial pupil, depends entirely on the knowledge, discrimination, and dexterity of the operator. The cases now alluded to are matters of daily occurrence, and make up the bulk of ophthalmic practice. The serious responsibility, which this view of the subject unfolds, will impel every conscientious practitioner to turn his anxious attention to the affections of this important organ, and to embrace all opportunities of acquiring that knowledge, which will enable him to act decisively and effectually on occasions of such momentous consequence.

"If there are any to whom the pleasure connected with the acquisition of knowledge, the satisfaction flowing from the consciousness of important duties rightly performed, and the gratitude so warmly expressed for the inestimable benefits of averting blindness or restoring sight

should not prove an incentive sufficiently powerful to the study of ophthalmic medicine and surgery, their case must be deemed desperate; unless, indeed, their minds, insensible to higher feelings and nobler motives, should obey the impulse of self-interest and fear; unless they should be affected by the prospect of disgrace and injury, which ignorance and its inseparable blunders must entail. The consequences of wrong treatment cannot be concealed here, as in the obscure affections of internal organs; the visible changes of structure are obvious to external observation, and the unfortunate individual, whose sight is injured or destroyed by unskilful treatment, serves as a lasting memorial of the incapacity and rashness to which he owes his misfortune. The study of diseases of the eye is therefore now justly regarded as an essential part of general medical education; but it is more particularly so to country practitioners, who are thrown entirely on their own resources; who cannot, as in the metropolis, and some large cities, call in the aid of superior talent and knowledge.

"Although the importance of the subject must be admitted, it may be doubted whether the ophthalmic branch ought to be separated from the rest of medicine and surgery, as it must be, to a certain extent, by devoting to it separate courses of lectures and treatises, and 'by instituting ophthalmic hospitals. The diseases of the eye, in general hospitals, are inadequate from the smallness of their number, to the purposes of practical study, particularly that of exemplifying the various operations. Thus these institutions have been inefficient in reference to this important department. As the general body of surgeons did not understand diseases of the eye, the public naturally resorted to oculists, who, seeing such cases in greater numbers, became better acquainted

with the symptoms, diagnosis, and treatment; and especially more skilful in the operative department. At the same time, the subject being imperfectly understood was neglected in the general surgical courses, in which many important affections of the eye were entirely unnoticed, and the whole inadequately explained. Thus students, who resorted to London for the completion of their professional studies, had really no means of learning this important department of the profession, which was tacitly abandoned, even by the hospital surgeons, and turned over to the oculists. The latter, not being conversant with the principles derived from anatomy, physiology, and general pathology, attended merely to the organ, and relied almost exclusively on what is comparatively of little importance, local treatment. Hence ophthalmic surgery, being in a manner dismembered from the general science, was reduced to a very low ebb. Until within a few years, it was, in this country at least, in a state of almost total darkness.

"It thus became desirable to establish an express and distinct school for diseases of the eye; not because the principles of treatment differ from those applicable to disease in general; nor because any peculiar mode of study is required; but in order to supply a deficiency in the existing sources of professional instruction; to provide for the affections of this important organ, those means of information, which the general hospitals neither do, nor could afford, consistently with their requisite attention to their other important objects. This proceeding, which at first view seems calculated to complete and perpetuate the separation, was the only rational mode of reuniting ophthalmic practice to general surgery.

"The more thoroughly any organ has been investigated, anatomically, physiologically, and pathologically, the better

shall we be prepared to treat its diseases. In this respect the eye is advantageously circumstanced; its anatomy is well known; its physiology clearly made out. A considerable portion of the organ is external, and the transparency of the front enables us to see much of its interior. We can observe the phenomena of disease, and the effects of remedies in some of its internal structures, in such parts as are elsewhere hidden from our view. The observations thus made on the eye are applicable to the illustration of disease and treatment in other organs. Hence if the general principles of medical science throw light on ophthalmic affections, the history and progress of the latter reciprocally afford valuable data for general pathology.

"But, can the diseases of any organ be well studied alone? Can they advantageously be made the subject of detached and separate investigation and treatment? The numerous organs which make up the human body, although various in structure and office, are all intimately connected and mutually dependent. They are merely subordinate parts of one machine; and they all concur, each in its own way, in producing one general result, the life of the individual. All the leading arrangements are calculated to give a character of unity to the organization and living actions of our frame. There is a common source of nutrition for the whole body; a single centre of circulation; hence all parts are immediately dependent for their nourishment and growth, and for the materials of their various exertions, on the digestive organs and the circulating system. There is a common place of union for sensations and volitions: the nervous system associates the actions of the various organs, and combines them for the common purposes of the economy; by means of it, the various organs *co-operate* in the healthy state, and suffer together,

or *sympathize* in disease. Thus the individual organs are not independent. The causes of their natural functions, and of those deviations which constitute disease, are not to be found within themselves, but mostly in the state of the constitution, or in that of some leading system of organs. Hence, in order to understand any part of the body, we must know the whole; and this holds equally good in disease as in health. Suppose a person complains of weak sight, we shall not be able to remedy the defect if we attend to the eye only, for probably there may be no visible alteration in the organ. We must look to the state of the circulation in the head, to the condition of the digestive organs; we must inquire into the patient's habits, into his diet, into his general mode of living, as well as into the causes which may be acting on the eye. Until this analysis has been made, we cannot know the causes of disease, nor can we arrive at clear grounds of treatment. We ultimately find that the eye must be cured, not by any direct or local measures, but by those of general influence; by loss of blood, purging, change of diet, and of other habits.

"In such a system, then, of intricate connection and mutual influence, each part will be best understood by him who has the clearest notions of the general economy. Even the practical proceedings will be most judiciously conducted by those who are in the habit of treating disease generally; who do not confine their attention to the part. This confinement is prejudicial, by producing and confirming habits of partial and narrow views, by leading to neglect of mutual relations and influences, by encouraging local treatment. Exclusive attention to a small corner of the animal structure causes a confinement of mental vision, analogous to the near-sightedness which mechanics contract by constantly poring over the minute ob-

jects of their attention. All the habits of the oculist lead to a separation and insulation of the organ. The part is detached from the system, treated by washes, drops, ointments; and this inefficient trifling impedes the progress of ophthalmic surgery. We want, instead of this, general and comprehensive views, the aid of analogy and contrast; the whole field of medicine and surgery must be laid under contribution for the principles which are to guide us in learning the nature and treatment of ophthalmic disease. Professed oculists have done little for the science, either here or abroad. The only real and valuable improvements have proceeded from men of extensive anatomical knowledge and of great general insight into disease."

Derrick Vail.

OBITUARY

THEODORE LASATER TERRY (1899-1946)

Theodore Lasater Terry was born February 19, 1899, at Ennis, Texas. He died September 28, 1946, at Boston, Massachusetts. Dr. Terry's preliminary education was obtained in Texas. He received a bachelor's degree from the Southern Methodist University, and his degree of Doctor of Medicine from the University of Texas in 1922. After serving his internship at the Henry Ford Hospital, Detroit, he did postgraduate work in general pathology at the University of Texas.

During the years that followed, Dr. Terry filled these hospital and teaching appointments:

Instructor in Medicine,	
University of Texas1925
Associate Professor, Pathology,	
University of Texas1926

Ophthalmic Resident,
Massachusetts Eye and Ear In-
firmery1927
Assistant Pathologist,
Massachusetts Eye and Ear In-
firmery1928
Pathologist and assistant Ophthalmic
surgeon, Massachusetts Eye and
Ear Infirmary1932
Ophthalmic Surgeon,
Massachusetts Eye and Ear In-
firmery1937
Assistant Professor of Ophthalmology,
Harvard University1940-46
Acting Head, Department of Ophthal-
mology, Harvard University ..
.....During the War.

An impressive record; each forward step based on diligence, hard work, and the efficient discharge of the duties of the one before—not a record of promotion by seniority, nor through influence. Nor did he rise by pulling anyone else down. But Dr. Terry, although a hard worker, was not a plodder, he had vision and ambition.

His vision and ambition appear most clearly in his work on retrolental fibroplasia. In the first place, he perceived, what was a surprise to us, that this disease is one of the most prevalent causes of infant blindness. In the next place, he regarded it as a problem; therefore, something to be solved, and he determined to devote himself to that task. Since the task was too complicated for one man, solving this problem would involve team work; so, he proceeded to enlist co-workers and, finally, to organize a corporation, "The Foundation for Vision," with powerful financial support and broad aims and powers. His plan was to pursue all clues and attack the problem of retrolental fibroplasia not only from the viewpoint of the pathologist, but from that of the embryologist, the statistician, and the sociologist, as well. He was able to kindle

enthusiasm in others because he had in himself the divine fire.

In addition to his affiliation with the American Medical Association, Dr. Terry



THEODORE LASATER TERRY

was also a member of the American Academy of Ophthalmology and Otolaryngology, the New England Ophthalmological Society (former president), the American Board of Ophthalmology (assistant secretary), the Association for Research in Ophthalmology (a trustee), the American College of Surgeons, and the American Association for the Advancement of Science. He was also a member of Sigma Nu, Alpha Kappa Alpha, the Harvard Club, and a lieutenant in the U. S. Naval Reserve, 1925-1927. His church affiliation was Presbyterian.

In 1942, Dr. Terry was awarded the certificate of merit from the American Academy of Ophthalmology and Otolaryngology for his research in retrolental fibroplasia, the disease which he named. If giving a disease a man's name were not taboo, retrolental fibroplasia undoubtedly would be known as "Terry's disease" because he did so much to make it known.

Dr. Terry's activities in the medical societies is apparent from a survey of the papers he published (list appended), but, like our most valuable members, he contributed much more in the discussion of papers by others than appears from a list of his own publications. Special attention may be called to his series of papers on malignant melanoma and his work on conical cornea.

Dr. Terry was married in December, 1934. Helen Terry was a true helpmate. They enjoyed travelling, especially by automobile, and had driven over a large part of this country in their specially equipped car. The unique home which they were developing was on a farm 25 miles from Boston. Always they had at hand one or two books on some topic of general interest which they were reading together—a book on history, economics, religion, politics, or especially, on the scientific advances in some field other than ophthalmology. These diverse interests made Ted an interesting companion. He was always the life of the party, a good story teller with ever a timely anecdote.

Dr. Terry had suffered repeatedly from hemorrhages from gastric ulcers and had had several operations and a dozen or more blood transfusions. He finally had the radical gastrectomy and neurotomy and was no longer threatened with this recurrent disability. Hence, it was a great disappointment to have what promised to be a most active and fruitful life cut off so prematurely by a cardiac complication.

Dr. Terry was a successful clinician and teacher, but his name will be forever associated with retrolental fibroplasia. The staggering difficulties, which beset the investigation of its cause, prevention, and treatment, served only to stimulate Dr. Terry's determination to overcome them. In this he displayed the characteristics of leadership, of enthusiasm, of patience, of scientific imagination, of tolerance of the views of others, of intolerance of any but sound scientific deductions, of ability to enlist the support and coöperation of others in what was obviously too huge a task for a single investigator.

Walter B. Lancaster.

PUBLISHED ARTICLES OF T. L. TERRY, M.D.

1. Neurogenetic tumors of the retina and optic nerve: Gliomata. *Texas State Jour. of Med.*, 1923, v. 19, p. 379.
2. X-rays ineffective against herpes virus. *Amer. Jour. Ophth.*, 1928, v. 11, July, p. 554.
3. The contact glass, its use in conical cornea, and errors of refraction. *Guildcraft*, 1931, v. 5, no. 2.
4. Histologic changes in an eye eight years after sclerocautery puncture of the retina. *Arch. of Ophth.*, 1932, v. 8, p. 182.
5. Sarcoma of eyelid: metaplasia of leiomyosarcoma to round cell sarcoma after repeated attempted excisions. *Arch. of Ophth.*, 1934, v. 12, p. 689. (With P. Mysel).
6. Metastatic carcinoma in both optic nerves simulating retrobulbar neuritis. *Arch. of Ophth.*, 1933, v. 10, p. 611. (With Edwin B. Dunphy).
7. Pulsating exophthalmos due to internal carotid-jugular aneurysms: Use of thorium dioxide sol in localization. *Jour. Amer. Med. Asso.*, 1934, v. 103, p. 1036. (With P. Mysel).
8. Angioid streaks and osteitis deformans. *Trans. Amer. Ophth. Soc.*, 1934, v. 32, p. 555.
9. Uveal sarcoma: Malignant melanoma. *Amer. Jour. Ophth.*, 1935, v. 18, p. 903. (With Juanita P. Johns).
10. Diathermy in cataract extraction. *Amer. Jour. Ophth.*, 1936, v. 19, p. 1105.
11. Abnormal arteriovenous communication in the orbit involving the angular vein. *Arch. of Ophth.*, 1938, v. 19, p. 90. (With G. B. Fred).
12. A modified corneal clamp to facilitate the insertion of stitches. *Arch. of Ophth.*, 1938, v. 20, p. 91.

13. Some physiological and anatomical aspects of the cornea affecting its pathology. *Amer. Jour. Ophth.*, 1939, v. 22, p. 153.
14. Studies on surface-epithelium invasion of the anterior segment of the eye. *Amer. Jour. Ophth.*, 1939, v. 22, p. 1083. (With J. F. Chisholm, Jr. and A. L. Schonberg).
15. Care of the Eyes, published in *Health at Fifty*. Edited by Dr. William Robey, Cambridge, Mass., Harvard University Press, 1939.
16. Malignant melanoma—so-called sarcoma of uvea: II. Problems in diagnosis. *Arch. of Ophth.*, 1939, v. 22, p. 989.
17. A plastic transilluminator. *Arch. of Ophth.*, 1940, v. 23, p. 164. (With R. D. Mattis).
18. Malignant melanoma—so-called sarcoma of uvea: III. Extension into the optic nerve. *Arch. of Ophth.*, 1940, v. 24, p. 206.
19. Studies on keratoconus relative to the effect of prolonged application of pressure. *Amer. Jour. Ophth.*, 1940, v. 23, p. 1089. (With J. F. Chisholm, Jr.).
20. Common glaucoma operations: Analysis based on histologic findings. *New York State Jour. Med.*, 1941, v. 41, p. 467.
21. Truss for application of pressure to the eye. *Amer. Jour. Ophth.*, 1942, v. 25, March, p. 333.
22. Extreme prematurity and fibroblastic overgrowth of persistent vascular sheath behind each crystalline lens. *Amer. Jour. Ophth.*, 1942, v. 25, p. 203.
23. Fibroblastic overgrowth of persistent tunica vasculosa lentis in premature infants: II. Report of cases, clinical aspects. *Arch. of Ophth.*, 1943, v. 29, p. 36.
24. Fibroblastic overgrowth of persistent tunica vasculosa lentis in infants born prematurely: III. Studies in development and regression of hyaloid artery and tunica vasculosa lentis. *Amer. Jour. Ophth.*, 1943, v. 25, p. 1409.
25. Fibroblastic overgrowth of persistent tunica vasculosa lentis in premature infants: IV. Etiologic factors. *Arch. of Ophth.*, 1943, v. 29, p. 54.
26. Some clinical applications of fluorescence in relation to melanotic pigment. *Amer. Jour. Ophth.*, 1943, v. 26, p. 536.
27. Retrolental fibroplasia in premature infants: V. Further studies on fibroblastic overgrowth of the persistent tunica vasculosa lentis. *Arch. of Ophth.*, 1945, v. 33, p. 203.
28. Ocular maldevelopment in extremely premature infants: Retrolental fibroplasia: VI. General consideration. *Jour. Amer. Med. Asso.*, 1945, v. 128, p. 582.
29. A visual defect of the prematurely born infant. *Outlook for the Blind.*, 1945, v. 39, p. 211.
30. Development of secretory function of ciliary body in the rabbit eye evaluated from ascorbic acid concentrations and changes in volume. *Arch. of Ophth.*, 1945, v. 34, p. 415. (With V. E. Kinsey and B. Jackson).
31. Further consideration of retrolental fibroplasia. *Jour. Pediat.*, 1946, v. 29, no. 6.
32. Retrolental fibroplasia. (With Vacharis, Merrill King, Edwin B. Dunphy, V. E. Kinsey, to be published in *Advances in Pediatrics*, 1947).

CORRESPONDENCE

MISGIVINGS AS TO THE TECHNIQUE OF CATARACT OPERATIONS

NOTE BY DR. CRISP:

Dr. Rivas Cherif, Mexico City, has written as follows with regard to certain points at which he feels he may have been somewhat misrepresented in the editorial appearing under the above title in the *American Journal of Ophthalmology* for December, 1946, page 1594.

DR. RIVAS CHERIF SAYS:

My paper (referred to in the editorial)

states at least a great part of the modifications or revivals of technique for extraction of senile cataract are good, useful, and advisable; but only when they are indicated. In my opinion the mistake is made in wholesale and systematic application of all the various modifications proposed by the various authors. The operator should select what seem the most useful of these proposals, omitting the less effective. It is not wrong to use innovations, but it is wrong to use a procedure, be it old or new, which is not indicated in the particular case. I am not a skeptic, but use innovations in cases in which I

believe they are indicated. I am not partial to the extracapsular method but use both methods, and I am thus in a position to compare the two. For this reason I can state positively that the postoperative reactions are comparatively less marked after extracapsular extraction. As regards the suggestion that excessive pressure may be exerted by Mexican surgeons who use the intracapsular method, I may state that in my own work I do not exert any pressure at all. Furthermore, mere tension on the fibers of the zonule is capable of causing increased ciliary reaction. As regards the question of waiting for maturity, in my opinion most patients show so much difference as to the stage of development of the cataract in the two eyes, that they are still able to use the unoperated eye after extraction of the mature cataract from the other eye. Even where the progress of the two eyes is more synchronous, there is no objection to waiting for full maturity in the second eye, and this will

imply that each of the cataracts can be operated upon at maturity.

(Signed) M. de Rivas Cherif,
Mexico, D. F.

X-RAY STUDIES IN RETINOBLASTOMA

In the January, 1947, issue of the JOURNAL, two cases of retinoblastoma are reported. It is not clear whether X-ray studies of the affected globes were made. Possibly if the technique of Pfeiffer, *Archives of Ophthalmology*, 1936, volume 15, May, pages 811-821, had been used, the finding of opaque areas of calcification might have led to an earlier diagnosis.

The procedure recommended by Dr. Pfeiffer can be employed by any careful roentgenologist, as it consists only in X raying the globe to demonstrate intraocular opacities. I recall two cases in which such X-ray studies furnished decisive information.

(Signed) Loren Guy,
New York, New York.

BOOK REVIEW

OPTIQUE INSTRUMENTALE. By G. A. Boutry. 540 pages. Paris, Masson et Cie., 1946.

It is refreshing to note that so admirable and interesting a book and one so beautifully printed can be produced in war-torn Europe. This book is based on a series of lectures to students and deals with the entire subject of instrumental optics, as distinguished from geometric optics, except computation. That subject is dealt with in a separate course. Optical principles are thoroughly elucidated without mathematics beyond the capability of an ophthalmologist. However, the oph-

thalmologist will read the book, for the most part, because the subject delights him, and not to increase his usefulness in his profession.

There are two chapters on the optics of the human eye and the corrections of the optical defects. The analysis of resolving power is discussed with particular clarity and interest. The last section of the book consists of a number of monographic chapters on individual optic instruments—lamps, the compound microscope, telescopes, binoculars, and photographic instruments.

F. H. Haessler.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

1

GENERAL METHODS OF DIAGNOSIS

Barrios, R. R., and Barriere, R. V. Regarding goniophotography. *Amer. Jour. Ophth.*, 1947, v. 30, Jan., pp. 49-51. (10 figures.)

Ferrié, Jean. The importance of questioning the patients for the diagnosis of ocular tuberculosis. *Ophthalmologica*, 1946, v. 111, June, pp. 332-338.

The author stresses the importance of the personal and family history as a diagnostic help in ocular tuberculosis. Five case histories illustrate the etiological problems of these diseases and their differential diagnosis.

Alice R. Deutsch.

Filatov, V. P., and Bushmich, D. G. Modification of Baillart's ophthalmodynamometer. *Oftal. Jour. (Odessa)*, 1946, pt. 2, pp. 7-8.

The modifications of the instrument consist in a device which locks the indicator so that it can be read after taking the instrument off the eyeball, and in the attachment of a 13-diopter lens to the stem of the ophthalmodynamom-

eter so that it can be used with indirect ophthalmoscopy. (Illustration.)
Ray K. Daily.

Guy, L. P. A ruler for measurement of visual fields on the tangent screen. *Arch. of Ophth.*, 1946, v. 36, Nov., pp. 617-619.

A rule is described by means of which one can measure angular distances on a tangent screen. The three surfaces of a triangular rod are so calibrated that one can measure fields taken at 1, 2, and 3, meters.

R. W. Danielson.

Maggiore, L. Modifications of the Schiötz tonometer. *Ann. di Ottal.*, 1946, v. 73, Feb., pp. 122-125.

The scale plate bears scales for the 5.5-gm., 7.5-gm., and 10-gm. weights in addition to the usual scale of 20 arbitrary gradations. By means of lines projected from the latter upon the other scales it is possible to read the tension directly in mm. Hg without recourse to a graph.

Not only the 5.5-gm. weight but also the 7.5-gm. and 10-gm. weights are

built into the instrument and may be brought into play, as required, by the simple turn of a lever. In this way the awkward changing of weights is avoided. Harry K. Messenger.

Pfeiffer, R. L. Roentgenography in ophthalmic diagnosis. *Arch. of Ophth.*, 1946, v. 36, Nov., pp. 639.

After listing and evaluating the uses of roentgen rays in ophthalmology, the author demonstrates and discusses recent contributions of roentgenology to the study of diseases of the eye. Deposits of calcium were found in approximately 80 percent of a large series of cases of retinoblastoma and calcium was observed microscopically in only an additional small percent. Internal fracture of the orbit was demonstrated as the cause of enophthalmos when there was no external bony deformity. Intracerebral deposits of calcium were the most important diagnostic finding in toxoplasmosis (9 cases). The value of roentgenography in the study of exophthalmos was emphasized by the fact that in 70 percent of 200 consecutive cases, changes were demonstrated roentgenologically. In 42 percent of all cases the changes were diagnostic. These diagnostic findings are illustrated by the presentation of a number of examples of each.

R. W. Danielson.

Reis, J. L. Use of "contact corneal rings" in X-ray localization of intraocular foreign bodies. *Brit. Jour. Ophth.*, 1946, v. 30, Aug., pp. 462-464.

The various methods used for X-ray localization of foreign bodies are all quite satisfactory; however they all require special equipment which, at least in war theaters, is difficult to obtain. The author describes a very thin metal ring, 0.1 mm. thick and 1.5 mm. wide,

which he cut from sheets of lead and tin alloy in which dental X-ray films are packed. He molds the ring on an artificial eye with his finger tips and places it on the cornea so that its outer edge is directly on the limbus. The strip remains in place by natural adhesion to the cornea and by pressure of the closed lids. Anteroposterior and lateral exposures are made and the usual three-dimensional measurements taken. (3 diagrams.) Morris Kaplan.

Sheppard, E. A. W., and Romejko, W. J. Gonioscopy. *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 159-164. (11 figures, references.)

Streiff, E. B. and Bischler, V. The precision of the ophthalmodynamometric method. *Ophthalmologica*, 1946, v. 112, July, pp. 19-24.

A thorough mathematical analysis of pertinent data demonstrates that ophthalmodynamometry is no less precise than tonometry. It should therefore take its place among the classic methods of ophthalmologic examination. (References.) F. Nelson.

2

THERAPEUTICS AND OPERATIONS

Assettati, Vincenzo. Results obtained by intravenous administration of Petraghani's M.F. tuberculin in some cases of ocular tuberculosis. *Riv. di Oftalm.*, 1946, v. 1, May, pp. 292-319.

Petraghani's M.F. vaccine is an extract from tubercle bacilli treated with phenol, acetone, sulfuric acid, and formol; the partigene "fenbattacin," thus obtained, is of high antigenic power, and is used in an undisclosed solution in seven concentrations. It is believed to be stable and has been used, since 1936, in pulmonary as well as extra-

pulmonary tuberculosis. Injections were given at intervals of four to twenty days in increasing concentration for three to eight months. No unfavorable reactions were observed; local and general reactions occurred but were transient only; they seemed to introduce a definite improvement in most instances. K. W. Ascher.

Azzolini, U. Severe involvement of cornea and of the skin during treatment with a goldarsenobenzol derivative. *Riv. di Oftalm.*, 1946, June, v. 1, pp. 361-373.

A 37-year-old woman developed lupus at the age of 25 years, and responded well to gold treatments, administered in two courses. After the second course, marginal infiltrations were observed in the cornea which became much worse during a third course of the goldarsenobenzol derivative. Bullous erythema developed on the face and neck, multiple deep yellowish-gray corneal infiltrations appeared and the visual acuity was reduced to the perception of hand movements. A recurrence of pleurisy, ulcerations of the mucous membranes of the larynx, severe diarrhea, and Eosinophilia accompanied the untoward reaction. Nine months later the visual acuity was 2/10 in each eye. The author discusses the allergic and idiosyncratic factors in the pathogenesis of these reactions to aurotherapy. K. W. Ascher.

Calamandrei, Giorgio. Personal experiences with penicillin treatment in ophthalmology. *Riv. di Oftalm.*, 1946, v. 1, March, pp. 180-188.

Local penicillin therapy proved to be successful in cases of conjunctival disease caused by staphylococci and by gonococci; in cases due to diplobacillus Morax-Axenfeld, zinc sulphate gave

better results. Penicillin ointments were found helpful in blepharitis if care was taken to combat the general deficiency. The results obtained in treatment of trachoma were not encouraging. Usually a solution containing 5000 Oxford units per c.c. was applied; in mild cases lower concentrations may be used. Penicillin will not displace all other drugs, particularly not those of the sulfa group. K. W. Ascher.

Carlevaro, Gianfranco. Histamin for ocular analgesia. *Riv. di Oftalm.*, 1946, v. 1, April, pp. 245-248.

Solution of bichloride of histamin administered intradermally or by iontophoresis proved to be helpful in combating pain connected with fifth nerve neuralgia, keratoconjunctivitis scrophulosa and other types of keratitis, scleritis, iritis, iridocyclitis, glaucoma, and ocular injury. In four patients suffering from severe pain connected with herpes zoster, daily histamin administration for a week allowed discontinuation of sedatives. While no effect on intraocular pressure was observed, preoperative histamin iontophoresis proved to be beneficial in patients suffering from acute glaucoma. K. W. Ascher.

Feldman, J. B., and Abrahams, H. J. Fluorescent colors in tangent screen examinations. *Arch. of Ophth.*, 1946, v. 36, Nov., pp. 537-539.

A method is shown by which fields can be taken on the tangent screen under regular illumination and plotted with the ordinary targets now in use, but marked off by invisible fluorescent colors read under ultraviolet illumination. R. W. Danielson.

Fontana, G. Sulfonamide treatment in ocular affections. *Rassegna Ital. d'Ottal.*, 1941, v. 10, May-June, p. 253.

The literature is reviewed and the result of treatment in 200 eyes is reported. Good results were obtained in catarrhal and gonococcic conjunctivitis, phlyctenular disease, and suppurative retrobulbar infections. Unfavorable results are reported in trachoma with corneal complications and in acute dacryocystitis.

E. M. Blake.

Harris, R., McGavack, T., and Elias, H. The nature of the action of dimethylaminoethyl benzhydryl ether hydrochloride (benadryl): effects upon the human eye. *J. Lab. and Clin. Med.*, 1946, v. 31, Oct., pp. 1148-1152.

The pupillary size and visual acuity of 20 ambulatory patients, free from ocular and autonomic disease, were studied before, during, and after the use of benadryl orally in doses of 150 to 400 mgm. daily, for 3 to 12 weeks. No perceptible change was noted.

In 60 subjects, 21 to 65 years of age, fresh 0.5-percent aqueous solution of benadryl was instilled each ten seconds for three doses into the right eye. In 48 patients the pupil increased an average of 1.9 mm. at the end of one hour, and in 12 patients there was no change in the pupil size. Dilatation started to decrease in two hours and was measurable at the end of 24 hours in only four patients. The visual acuity was decreased in 12 patients and unchanged in 48, and the accommodation was decreased in 43 patients. No change was noted in pupillary size or accommodation in any left eyes at 1, 15 and 60-minute intervals.

In six patients one drop of 1/1000 epinephrin solution was instilled with the three benadryl drops, which led to maximum dilatation in 15 minutes, but the dilatation was not greater than in those who did not receive the epinephrin.

One percent solution of homatropine sulphate caused a greater increase in pupillary size in 15 subjects, when benadryl drops were added than alone. Benadryl lessens the miosis produced by eserine. Applied topically to the human eye benadryl seems similar to atropine in paralyzing the vagus. (2 tables, references.)

Bennett W. Muir.

Iliff, C. E. Beta irradiation in ophthalmology. *Trans. Amer. Acad. Ophth.*, 1946, Sept.-Oct., pp. 36-46.

Because of its limited penetration and ease of application, beta irradiation is especially suited for radiation therapy of the anterior part of the eye. A special soda-glass-windowed brass applicator containing 200 to 500 mc of radon is applied at a distance of 1 to 3 mm. from the lesion. The dosage is measured in gram seconds, 12 is the maximum for one treatment and 18 for a two-week series. After rest periods of two weeks, one or more series may be subsequently given. In 60 patients with vernal conjunctivitis 18 percent were cured, 63 percent were improved, and 7 percent were unimproved. Of 72 eyes with anterior ocular tuberculosis, vision was improved in 42 percent, maintained in 46 percent, and decreased in 12 percent. In 24 cases of benign tumor of the lids and conjunctiva, mostly angiomas and papillomas, the results were excellent. In chronic corneal affections where it is desirable to decrease vascularization the results were good.

Chas. A. Bahn.

Jona, Sergio. Investigations concerning the action of choline and some choline esters on the normal human eye. *Riv. Oto-Neuro-Oft.*, 1941, v. 18, Nov.-Dec., pp. 510-529.

Choline, acetylcholine, Doryl, mech-

olyl, and lymphogangline were used on four normal persons to study the effect of instillation into the conjunctival sac. Pupillary diameters, intraocular vascular pressure, caliber of the retinal vessels, and intraocular pressure are shown in extensive tables. In some experiments the instillation of pilocarpine, or homatropine preceded the drug to be studied. Some experiments were performed by subconjunctival administration of the solution. Instillation of choline, acetylcholine, and lymphogangline did not produce marked changes whereas doryl instillation was followed by a definite decrease of tension; subconjunctival injection of choline and of lymphogangline induced a slight fall of intraocular pressure. A decrease of the retinal arterial blood pressure and an increase of the diameter of the retinal arteries followed subconjunctival injection of lymphogangline.

K. W. Ascher.

Katzin, H. M. Animal operating equipment for experimental ocular surgery. *Arch. of Ophth.*, 1946, v. 36, Aug., pp. 215-219.

An operating table mounted on the elevating table of a Zeiss slit lamp is described. The swinging arm of the slit lamp is utilized to hold a microscope or camera. Illumination is provided by a hammer lamp mounted on a gooseneck. The animal, usually a rabbit, is fixed to the table by adjustable leg clamps. A circular hand rest is provided. Details of the construction and utilization of the table are given.

John C. Long.

Kuhn, H. S. Sodium sulfacetamide 30-percent solution in ophthalmology. *Trans. Amer. Acad. Ophth.*, 1946, May-June, pp. 210-213.

Dickson, in Scotland, found the inci-

dence of ulcers among miners after the removal of foreign bodies was markedly reduced by the use of 10 percent sodium sulfacetamide, which in England goes under the name of "Albucid."

Kuhn routinely uses a drop of the 30 percent solution every four hours for three days, after the removal of a foreign body. The ointment may be used nightly if there is conjunctivitis. Neither the drops nor ointment are irritating and no allergic reactions have occurred.

Chas. A. Bahn.

Leopold, I. H., and LaMotte, W. O., Jr. Influence of penicillin on the course of ocular lesions due to a toxic agent. *Amer. Jour. Ophth.*, 1947, v. 30, Jan., pp. 41-48. (6 figures, references.)

Maione, Mario. Experimental and clinical contribution on the antiseptic action of mercurochrome in ophthalmology. *Ann. di Ottal.*, 1946, v. 73, Feb., pp. 114-121.

Mercurochrome was introduced into Italy in 1942. Tests made in vitro with conjunctival flora show that it has greater antiseptic properties than protargol and mercury oxycyanide. Experiments made in vivo show that it can kill germs in the conjunctival sac and that it can be used advantageously in septic affections of the globe and its adnexa.

Maione proposes its administration in the form of gelatin disks so as to avoid contact with the skin. The undesirable local reactions described by others may be due to contact with the acid perspiration of the lids. Mercurochrome is precipitated in an acid medium, with the formation of irritating compounds, but is not precipitated in the alkaline medium of the conjunctival sac. With alkaloids it forms insoluble compounds, but Maione concludes that

mercurochrome and neutral atropine sulfate may be used together without any danger. Harry K. Messenger.

Marconcini, Eraldo. The action of the amide of nicotinic acid on the optic nerve of animals (rabbits) poisoned by quinine (hydrochloride). *Arch. di Ottal.*, 1946, v. 50, Jan. and Feb., pp. 19-43.

The therapeutic uses of nicotinic acid and its amide in ophthalmology are reviewed. Rabbits were given 180-240 milligrams of quinine hydrochloride intramuscularly for nine to twelve days, after which one eye was enucleated. After one day of rest the rabbits were given nicotinamide for 14 to 24 days, when the remaining eye was enucleated.

The first eye showed the usual degeneration of the myelin sheaths. The nerve of the other eye showed an almost complete regeneration of the myelin tissue and disappearance of the fatty degeneration characteristic of quinine poisoning.

The author assumes that the improved metabolism due to the vasodilating action of the nicotinamide, and the increased gaseous exchange, that is ascribed to the action of nicotinamide may explain its action on the elements of the optic nerve.

Francis P. Guida.

Moreu, Angel. Chemotherapy of ocular infections. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Sept., pp. 797-802.

The treatment advocated by Moreu consists of a massive dose of foreign protein, large oral doses of sulfa drugs, paracentesis and evacuation of the anterior chamber 24 hours after institution of treatment, and autochemotherapy every 48 hours, if necessary. In serpig-

inous ulcer a contact lens filled with the patient's blood is applied to the cornea, to bathe the cornea in blood which has a high concentration of the sulfa drug, and to stimulate the local defensive forces. These procedures invariably arrested the process in 18 cases of purulent iridocyclitis and serpiginous ulcer.

Ray K. Daily.

Payot, Pierre. The influence of anesthetics on histamine chemosis in rabbits. *Ophthalmologica*, 1946, v. 112, July, pp. 25-38.

A five-percent aqueous solution of histamine (-HCL) instilled into the eye of a rabbit produces a conjunctival chemosis after approximately five minutes. If an anesthetic, such as cocain, is applied first, the degree of chemosis is considerably reduced. This inhibition is not ascribed directly to an antihistamine action or to an affect on the nerves. The anaesthetic holocain produces chemosis by itself. (1 curve, 1 table, references.) F. Nelson.

Regoli, A. Concentration of sulfa-pyrodine in the aqueous after local application. *Rassegna Ital. d'Ottal.*, 1941, v. 10, May-June, p. 269.

Experiments on rabbits revealed a good concentration of the drug after application of ointments and instillation into the conjunctiva, and an even higher concentration after subconjunctival injection. Intraorbital injection produced very slight concentrations in the aqueous.

E. M. Blake.

Sorsby, A., and Ungar, J. Pure penicillin in ophthalmology. *Brit. Med. Jour.*, 1946, Nov. 16, pp. 723-731.

Penicillin in use up to a few months ago contained 80 to 90 percent of impurities; now most of it is up to 80 per-

cent pure and limited quantities of pure penicillin are available.

The pure substance combined with calcium or sodium is crystalline, yellowish white, freely soluble, and more stable than commercial (impure) penicillin. The dry form remains stable at room temperature for many months. Aqueous solutions, if kept sterile, remain active at room temperature for 14 days and retain potency up to four weeks if kept on ice. One milligram of pure penicillin corresponds to 1660 units.

Commercial penicillin in the usual clinical doses, used systematically, does not penetrate into the interior of the eye. Locally, in the conjunctival sac, it is not tolerated. It gives rise to hyperemia, discomfort, and sometimes to damage of corneal epithelium. Subconjunctivally, the eye tolerates from 600 to 2000 units in 0.5 mils of water.

Tolerance experiments with pure penicillin were performed on rabbits' eyes. Guinea pigs were unsatisfactory for study. Drops and ointments in concentrations up to 100,000 units per mil or gram were well tolerated in the conjunctival sac. Up to 50,000 units in 0.5 mils of water can be injected subconjunctivally, and intravitreal injections of 10,000 units in 0.2 mils can be made. Pure penicillin should be dissolved in water rather than in normal saline solution to avoid a hypertonicity. Anterior chamber infections in experimental animals were readily controlled by the use of concentrated ointment and subconjunctival and systemic injections. Aqueous therapeutic levels of the drug may be maintained by the use of concentrated ointments in the conjunctival sac but higher and more persistent levels are secured by conjunctival injections. Systemic massive doses may be adequate but evanescent. Adrenalin

in the solution used for subconjunctival injections increases persistence. Intramuscular beeswax injections give more sustained levels.

Francis M. Crage.

Souders, B. R., and Forestner, H. J. **Plastic ocular prostheses in unusual sockets.** *Trans. Amer. Acad. Ophth.*, 1946, Sept.-Oct., pp. 46-52.

A method of socket impression and prostheses especially adapted to deformed sockets is described and illustrated with two case reports. For the impression a finely powdered alginate gel is used which sets in from two to five minutes. An impression tray of acrylic resin with a scleral radius of 12 mm. and a corneal bulge of 7.5 mm. is located slightly nasal to the center of the tray. A plaster bowl, Jaeger spatula, iris spatula, and muscle hook comprise the rest of the equipment. The technique involves the mixture, molding, impression, and trimming of the impression material, also the fabrication of the prosthesis which is made of methyl methacrylate. The iris is colored with oil pigments or a glass iris from another prostheses is used. (18 figures.)

Chas. A. Bahn.

Van Loon, J. A. **The cold pressor test in ophthalmology.** *Ophthalmologica*, 1946, v. 112, Aug., pp. 63-71.

The cold pressor test is a standard method for measuring the reaction of the vascular system. The blood pressure is measured at regular intervals (at first every 30 seconds, then every minute) after immersion of the hand into ice water. Normally the rise in systolic and diastolic blood pressure does not exceed 12 and 10 mm. Hg respectively. A greater rise is called a hyperreaction and is seen in hypertension. Patients with spasm of the retinal

arteries have a systolic and diastolic hyperreaction even when the blood pressure is normal. Patients with thrombosis of the central vein of the retina usually have affections of the heart and blood vessels, but react normally to the cold pressor test, except when they have coexistent hypertension. In eight patients with visual disturbances who for various reasons had increased vasomotor irritability (quinine or nicotine poisoning), a distinct hyperreaction to the cold pressure test was also found. (4 figures, 2 tables, references.) F. Nelson.

Vorisek, Elmer A. Evaluation of the newer therapeutic agents in ophthalmology. *Amer. Jour. Ophth.*, 1947, v. 30, Jan., pp. 29-40. (References.)

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Adrian, E. D. Rod and cone components in the electric response of the eye. *J. Physiol.*, 1946, v. 105, July 15, pp. 24-37.

The electric response of the human eye to a flash of light can be divided into a rapid component apparently associated with the photopic mechanism, most prominent with long wave-length light, and a slow component of the scotopic mechanism, most prominent with short wave-length light. Records obtained from monkeys, whose vision is nearest that of man, and pigeons, who have good colour vision and many cones, showed in each species the dual type of response. The scotopic component was smaller in pigeons than in the other two. Records from cats and rabbits, which have few cones, and guinea-pigs, in which rods predominate, gave tracings in which it was impossible to distinguish two components. The

light adapted rod mechanism of the guinea pig gave a response which resembles the photopic effect. Records were also made of the optic nerve of the cat, rabbit, and guinea pig, and from the striate area of the monkey brain, which showed little more than the apparent lack of correspondence between the electric response of the eyeball and the discharge of impulses from the retina. (17 figures, references.)

Bennett W. Muir.

Beach, S. J. Current problems of myopia. *Trans. Amer. Acad. Ophth.*, Nov.-Dec., 1945, pp. 66-70.

Groups of myopic patients were classified according to the distances at which the use of uncorrected vision caused the most discomfort. A small number of patients had discomfort at all distances; a much larger group had discomfort especially for distance; a small group had symptoms for middle distance; and an inconsistent group had symptoms especially following close work. Most of the subjects with low myopia were found in the second and fourth group. The criteria of myopia included visual acuity test, retinoscopy and refraction in cycloplegia, and near point tests.

Squeezing and retraction theories of myopia and some practical problems in the author's experience are discussed.

Chas. A. Bahn.

Chapanis, A. The dark adaptation of the color anomalous. *Am. J. Physiol.*, 1946, v. 146, Aug., pp. 689-701.

A relationship between dark adaptation and color blindness was found in recent studies of color defectives. Results of red and violet dark adaptation tests on red anomalous, violet anomalous, and normal subjects are given.

F. M. Crage.

Cotlier, I. Applications of the colored velonoscope in the study and final correction of astigmatism. *Anales Argentinos de Oft.*, 1946, v. 7, Jan.-Feb.-March, pp. 1-6.

Using the technique of Trantas, but employing a colored velonoscope, one can determine, by movement of colored shadows, whether astigmatism exists, the direction of movement of the principal meridians, and the dioptric strength of these meridians. The author's method simplifies and makes more secure the older technique of velonoscopy. (Bibliography, 5 illustrations.) Edward Saskin.

Dallos, J. Sattler's veil. *Brit. Jour. Ophth.*, 1946, v. 30, Oct., pp. 607-613.

Sattler's veil is the name given to the haziness that occurs in the vision of contact lens wearers as a result of corneal edema. It has been ascribed to "internal suffocation" as a result of interference with the circulation of the blood. "Outer suffocation," due to the elimination of free access of air to the cornea has also been postulated. To test this theory, Dallos drilled several tiny holes in the corneal part of his lenses near the upper part of the limbus. In two patients there was some increase of tolerance of the contact glass. The essential characteristics of an adequately fitted contact glass are discussed. Morris Kaplan.

Deloge, C. Visual reëducation in aniseikonia. *Ann. d'Ocul.*, 1946, v. 179, March, pp. 149-157.

Inequality of the retinal images of more than four degrees usually produces symptoms. Inequalities may be constitutional or acquired and include anisometropias of more than two diopeters, conical corneas, and other abnormalities which change the size or shape

of one or both retinal images. A psychic struggle results because the visual images are not blended into a harmonious three dimensional concept, but each eye struggles with the other for supremacy.

The optical treatment of anisikonia is accomplished by contact glasses and by lenses with the proper combination of thickness, curve, and index of refraction to equalize the size of the two retinal images. Prismatic glasses are of no value. The optical treatment is complicated by the fact that the size and shape of retinal images vary with the distance of the object viewed. The author believes that the Dartmouth school has secured great optical accuracy in the measurement of anisikonia but has not sufficiently emphasized the human factor in its treatment. The author examined a series of patients with anisometropia with the diploscope of Remy. Several with severe monocular amblyopia with and without high refractive errors were greatly improved by monocular occlusion of the better eye. In the second stage of treatment he strove for the production of alternating vision; and in the third for the development of simultaneous vision. During the first stages of orthoptic training slight strabismus or nystagmus may be observed. The symptoms associated with anisikonia do not exist if one eye is suppressed as in using a monocle. (References.)

Chas. A. Bahn.

Doesschate, J. T. Visual acuity and distribution of percipient elements on the retina. *Ophthalmologica*, 1946, v. 112, July, pp. 1-18.

The author presents a theoretical, largely mathematical analysis of pertinent known data. Theoretically one would expect the visual acuity to be di-

rectly proportional to the number of percipient units per unit of retina. This is true for a central area whose radius is 10 degrees. That it is not true beyond this circle is explained by assuming that in the retinal periphery percipient units consist of groups of percipient histologic elements. The total number of percipient units appears to be the same as the number of fibers in the optic nerve. (3 figures, 5 tables, references.) F. Nelson.

Druault, A. Visual symptoms following the use of the microscope. *Ann. d'Ocul.*, v. 179. March, 1946, pp. 138-142.

In the use of monocular instruments such as the ordinary ophthalmoscope, retinoscope, and keratometer, the closure of the nondominant eye or the suppression of its visual image is necessary for those who are not ambiocular. After prolonged use of these instruments the author reports a frequent doubling of horizontal but not of vertical lines. This is attributed to a mechanical modification of the lens caused by a peculiar type of accommodation involved, and is further increased by faint transverse folds in the corneal epithelium that result from decreased winking and increased pressure of the lids. In the use of monocular optical instruments, the relationship between accommodation and convergence is disturbed. Accommodation is relaxed, but the tendency for convergence is maintained. This results in frequent homonymous diplopia of nine prism diopters or less and may be demonstrated by placing a red glass before the observing eye. The addition of a +1.50-diopter sphere to each eye may reduce symptoms. If they continue, a frosted glass may be worn before the nonobserving eye. Chas. A. Bahn.

Gardner, H. O. Obstacles in the orthoptic treatment of squint. *Jour. Iowa State Med. Soc.*, 1947, v. 37, Jan., pp. 17-21.

The most frequent causes of failure are amblyopia, suppression, abnormal retinal correspondence, vertical imbalances and poor cooperation of parents or child. The treatment of amblyopia succeeds best before the age of six years, and requires corrective lenses, and constant, complete occlusion of the fixating eye. Suppression and abnormal retinal correspondence are best treated by occlusion and stimulation on a major amblyoscope. The most common cause of failure is an uncooperative parent. I. E. Gaynon.

Goldmann, H. A directly registering adaptometer based on a new principle. *Ophthalmologica*, 1944, v. 107, Jan.-Feb., pp. 55-59.

The author describes his mathematically exact registering adaptometer. The instrument covers a wide range of intensity of illumination (1 to 10^{-5}) and registers the data as a logarithmic graph. This instrument gives a complete and exact adaptation curve such as is desirable for purposes of research. (3 drawings, 1 picture.)

Max Hirschfelder.

Hartridge, H. Colour receptors of the human fovea. *Nature*, 1946, v. 158, July, pp. 97-98.

A retinal micro-stimulator, consisting essentially of a microscope used in reverse, which presents to the eye of the observer a greatly diminished image of a white test-light, was devised. With this it was possible to move a narrow exploring pencil of light slowly and under control over the fovea, and to test point by point the colour vision of the chosen retinal area. In some

places the light appeared red (matching light of 6,400 Å), in others green (matching light of 5,400 Å), in others blue (matching light of 4,800 Å), and between these points numerous other areas with nonspecific white or yellow response. The precise positions of these points could be measured as the distance from the test-light from the fixation light. From these data it was inferred that the Young trichromatic theory of colour vision is substantially correct, with additional yellow or white receptors, or both, that fixation can be so precise that it is possible to stimulate either single cones or very small groups of cones, and that it has been possible to identify with the precision of at least half "the cone intercentre distance" the position of some of the receptors which possess specific colour properties. Bennett W. Muir.

Holmes, W. J. Night vision. *Arch. of Ophth.*, 1946, v. 36, Aug., pp. 141-154.

Two hundred and seventeen high school students of Japanese ancestry and an equal number of Caucasian ancestry were subjected to identical tests of their day vision, night vision, and yellow and blue perception. There was no perceptible difference in the corrected day vision of the two groups. Myopia or myopic astigmatism was found in 28.11 percent of the Japanese children and in 5.07 percent of the Caucasian. Blue and yellow perception was essentially normal in each group. The Japanese as a whole did less well in all of the tests for night vision. The results obtained with the S. A. M. Night Vision Tester, with the Hecht-Shaler adaptometer and in the Harman, Ferree-Rand, and Luckiesh-Moss tests are analyzed. Various theories are stated to account for the definite difference in night

visual acuity in the two groups. These include hereditary factors, such as questionable embryologic and morphologic differences between the two races, greater frequency of myopia and trachoma among the Japanese, and inadequate dietary intakes of vitamins A and B and of calcium, and abnormal ration of calcium and phosphorus in the Japanese diet. John C. Long.

Kirschberg, L. S. S. Depth perception and flying ability. *Arch. of Ophth.*, 1946, v. 36, Aug., pp. 155-170.

This is an analysis of data gathered in the examination of trainees in the Royal Canadian Air Force. Binocular depth perception was measured with a modification of the Verhoeff instrument. It was found that with this instrument in a single test a subject's binocular depth perception could be classified as "good," "average," or "poor." Among 303 student pilots there was a strong indication that good visual acuity is an important factor in depth perception. In a series of 504 aircrew trainees it was shown that amplitude of fusion and depth perception scores were independent of one another. It was further shown that there was a relationship between the performance on the instrument used to measure amplitude of fusion (Worth Amblyoscope) and the instrument used to determine desire for fusion (Harman Diaphragm). It was not possible to demonstrate any definite relationship between desire for fusion and depth perception, nor was there a demonstrable relationship between depth perception scores and heterophoria. There was a complete lack of relationship between depth perception and flying ability. Also there was no relationship to flying ability and orthophoria or desire for fusion. John C. Long.

Lauber, Hans. The performance of the visual field. *Revue Bulgare d'Opht.*, 1943, v. 2, pp. 95-99.

The author presents a three-dimensional model that exhibits the characteristics of the visual field, a so called field island. The top of the island corresponds to the fixation point, the isopters are shown in planes, at successive levels. The blind spot forms a vertical channel which extends down to the zero-plane. (7 figures, references.)

Alice R. Deutsch.

Ludvigh, E., and Kinsey, V. E. Effect of long ultraviolet radiation on the human eye. *Science*, 1946, v. 104, Sept. 13, pp. 246-247.

In seven individuals, the foveal light-difference sensitivity and critical flicker frequency of each eye was tested before and after the exposure of the left eye only for five minutes to light which had been filtered so as to contain rays near 360 mμ. There was no statistically significant difference in the results as a consequence of the exposure, from which the authors conclude that ultraviolet radiations greater than 320 mμ encountered in nature are without deleterious effect upon those two functions of the human eye. (1 figure, references.)

Bennett W. Muir.

Maggiore, L. Device for doing dynamic skiascopy with a hand electric ophthalmoscope. *Ann. di Ottal.*, 1946, v. 73, March, pp. 183-187.

The device is essentially a plate of transparent glass and a 3-cm. opaque black disk with a central 3-mm. round sighthole. These are in a mounting for attachment to the ophthalmoscope handle in place of the ophthalmoscope head. The plate is mounted at an angle of 45° in front of the disk. Light from

the lamp in the handle is reflected by the polished surfaces of the plate into the patient's eye, and light reflected back from the fundus of the latter passes through the plate into the observer's eye behind the sighthole. Retinoscopy can thus be performed in the same manner and on the same optical principles as with a plain mirror with a central opening.

(The term "dynamic skiascopy" is used in contradistinction to Strampelli's "static skiascopy," but the method is the same as our ordinary retinoscopy.)

Harry K. Messenger.

McCulloch, C., and Crush, M. Clinical aspects of stereopsis. *Arch. of Ophth.*, 1946, v. 36, Aug., pp. 171-188.

The authors report upon a series of studies conducted in the Royal Canadian Air Force. Stereopsis and suppression were measured in the synoptophore with specially prepared slides that gave quantitative measurements. Stereoptic acuity varied directly as the visual acuity. Decrease in stereoptic acuity accompanied increase in the amount of the suppression. Unilateral or bilateral myopia or myopic astigmatism with vertical axis reduced stereoptic acuity in proportion to the increase of the error. Acuity of stereopsis was reduced but could be maintained partially in myopic astigmatism with horizontal axis, any hypermetropic astigmatism, and in anisometropia. Acuity of stereopsis was not affected in hypermetropia. Increase in the size of the test objects improved stereoptic acuity. Increase in the separation of the test objects decreased stereoptic acuity. Convergence, heterophorias, age, and accommodation showed no correlation with acuity of stereopsis.

John C. Long.

Plicque, J. Analysis of binocular vision. *Ann. d'Ocul.*, 1946, v. 179, Feb., pp. 83-102.

Fixation in binocular macular vision and depth perception are greatly facilitated by the decussation of the macular fibers in the superior colliculus. The size of retinal images may be measured with the eiseconometer, the Remy diploscope, the apparatus of Gramont, or the stereoscope. Binocular perception of depth is an instantaneous phenomenon which depends upon bilateral integration of occipital lobe impulses derived especially from the macula. Depth perception may be altered by the stereoscope which changes the normal binocular relationship between accommodation, convergence, and distance estimation. A slight change of angulation and decentralization on stereoscopic charts changes the estimation of distance. Binocular vision is largely macular vision and therefore depends on cone function. Beyond a 15 degree radius from the macula peripheral vision is supplementary. Physiologic diplopia is of little importance in binocular vision. In the maintenance of binocular vision accommodation, convergence, and extraocular coordination of the extraocular muscles are essential. Conditions which affect the easy integration of the occipital macular impulses of both eyes such as anisomotopia, anisocoria, and conical cornea interfere with binocular vision. (References.) Chas. A. Bahn.

Ribas Valero, Ramon. The stenopeic slit. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, April, pp. 384-409.

This is a detailed description of the technic of examination for astigmatism by means of the stenopeic slit. Two methods are described in one the ste-

nopeic slit is used with the astigmatic dial, and in the other with optotypes.

Ray K. Daily.

Richardson, J. A., and Kinard, F. W. Effects of vitamin A administration upon defective color vision. *South. Med. J.*, 1946, v. 39, Oct., pp. 811-813.

Twelve healthy medical students were given fifty thousand units of vitamin A daily and seven were given placebos for a period of eight weeks. Improvement in color vision as tested with pseudoisochromatic charts was negligible. I. E. Gaynon.

Sasiain, M. R. The effect of altitudinal hypoxemia on the light sense, color sense, and the visual field. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Sept., pp. 721-737.

These studies were made in a pressure chamber, corresponding to an altitude of 5,000-5,500 meters. Below 4,000 meters the hypoxemia can be compensated and the normal physiologic functions maintained. Above 6,000 meters compensation is impossible and pressurized equipment is essential. The altitude of 4,500 to 5,000 meters represents an intermediate zone, in which the hypoxemia can be compensated to the extent of avoiding syncope, but not to the extent of eliminating all phenomena produced by it. The central visual acuity, ocular tension, and the caliber of the central retinal artery are not affected by altitude. In 25 young men without nutritional deficiencies the light sense was found diminished with altitude. The recuperation time after dazzling is shorter at an altitude than on the ground. In 80 out of 100 tests the light sense improved with dark adaptation, and in 20 it diminished in spite of dark adaptation. The color

sense was investigated in 70 young men of whom 64 had trichromatic color vision and six dichromatic. It was found that in normal trichromatic subjects the color sense is not affected by altitude. Dichromatic and protanopic subjects become more deuteranopic with altitude and deuteranopia is exaggerated. The visual field was tested on the Forster perimeter with 1-cm. objects, on 20 young men, of whom 14 were emmetropic and six were myopic. It was found that the visual fields for white, red, yellow, and blue become constricted with altitude. The degree of the constriction varies in different individuals, and for different colors; the average is between 4 and 10 degrees. The field for green shows a constant extension with 15 degrees as the maximum, and 1 degree as the minimum, and an average of five. This widening of the field for green is smaller, more regular, and constant, than the constriction for white and other colors. Ray K. Daily.

Sasiain, M. R. The situation of the far point of the emmetropic eye. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, April, pp. 362-366.

This laboratory investigation was made on 40 persons who focused for clearest vision while looking through a telescope with oculars ranging from minus six to plus six diopters. On the basis of this study, supported by a review of the literature the author concludes that the punctum remotum of the emmetropic eye in repose is not at infinity. The eye at rest is accommodated for a finite distance of about two meters, where the far point of the eye is. The eye is capable of a negative accommodation for fixation at infinity, the amplitude of which is 0.80 diopter as a maximum. The mechanism of negative

accommodation is as yet uncertain. (2 graphs.) Ray K. Daily.

Shevaley, V. E. A simplified prismoptometer. *Oftal. Jour. (Odessa)*, 1946, pt. 2, pp. 34-38.

Shevaley combined the two prisms, which constitute this instrument, in such a way that they can be placed in a trial frame behind the correcting lenses. This simplified arrangement makes easily available an otherwise expensive instrument. He believes that the instrument provides a reliable means for performing a rapid subjective refraction test. (7 illustrations.) Ray K. Daily.

Slaughter, Donald. Sulfonamides and dark adaptation. *J. Lab. and Clin. Med.*, 1946, v. 31, Sept., pp. 987-990.

Three groups of six individuals, were given four grams of sulfanilimide, sulfathiazole and sulfadiazine, respectively, for three days. Dark-adaptation, as measured by the Feldman adaptometer, was not altered by sulfathiazole, sulfadiazine or sulfanilimide.

I. E. Gaynon.

Van der Velden, H. A. The number of quanta necessary for the perception of light of the human eye. *Ophthalmologica*, 1946, v. 111, June, pp. 321-331.

A method for the determination of the number of absorbed quanta in the visual purple necessary for the perception of light in rod vision is described. From the observation of light flashes it is possible to fix this number without knowing anything about the part of light absorbed by the visual purple.

The experimental technique is described and the mathematical analysis of the data is discussed in detail. The agreement between theory and experiment is emphasized.

The experiments indicate that two effective quanta are needed for the creation of a light stimulus and that a co-operation between two rods which each have undergone a change of one light-quantum are essential. This is in accordance with the concepts of nerve physiology. (4 figures, references.)

Alice R. Deutsch.

Viallefont, H. Entopic examination of the retinal arteries. *Ann. d'Ocul.*, 1946, v. 179, March, pp. 127-130.

Oblique scleral transillumination through the closed lids preferably in the lower nasal quadrant, is followed by entopic visibility of the retinal vessels and disc. This is the familiar Purkinje phenomenon which may be easily demonstrated by pressing against the lower lid an ordinary electric ophthalmoscope with the head removed. Both eyes should be closed and the patient should look somewhat nasally, while the ophthalmoscope is moved in a rotary manner. The retinal vessels appear as brown lines on a dark pink background. By increasing the pressure of the ophthalmoscope on the eyeball, the author observed a bright stellate figure with undulating lines which appear and disappear synchronously with the radial pulse. The exact mechanism of this pressure reaction is not understood, nor why it radiates about the disc rather than the macula. Its further study is suggested in conditions with altered intraocular and intravascular pressure relationships, such as glaucoma, aortic insufficiency, and vascular hypertension.

Chas. A. Bahn.

Convergence insufficiency bears no relationship to refraction, and is not cured by correcting refractive errors, except occasionally in under-corrected myopia and over-corrected hypermetropia. Prisms will not cure it because they do not develop a convergence reserve. Operation has not proved satisfactory in the author's experience. Extreme insufficiency, however, may become heterophoria. Convergence insufficiency may occur at any age from adolescence to the late fifties. Subjective symptoms are fairly constant. Measurements with Maddox rod and screen test are not diagnostic. They do not indicate convergence reserve. Repeated convergence on a test object is a quick and accurate test for convergence insufficiency.

Seventy percent were cured. The failures usually had complicating factors such as aniseikonia, physical or nervous disturbances. Cures were only possible when there was a good fusion amplitude with fusion reserve and a good recovery point. Some people became comfortable after a few treatments and failed to return until their symptoms recurred one to three years later. The correction of convergence insufficiency with esophoria was found to take the longest time because correct abduction had to be taught as well as adduction. Some typical cases are reported in brief.

Theodore M. Shapira.

Lijó Pavía, J. The orthofusor, amblyoscope, and prisms; indispensables in the treatment of strabismus. *Rev. Oto-Neuro-Oft.*, 1945, v. 20, Nov.-Dec., pp. 142-154.

To treat properly any given case of strabismus it is necessary to determine the visual capacity, the surgical need and procedure, to prescribe the proper optico-prismatic aid, and to reeducate

4

OCULAR MOVEMENTS

Davies, C. Orthoptic treatment of convergence insufficiency. *Canad. M. J.* 1946, v. 55, July, pp. 47-49.

or perfect the visual capacity through the amblyoscope and orthofusor. The orthoptic training reduces any existing amblyopia, treats abnormal retinal correspondence, and encourages binocular single vision. The author advises stimulation of binocular vision soon after (10 days) operation has been performed, and the early use of occlusion. The angle of anomalous retinal correspondence must be determined and overcome early. (Such a condition may be associated with triplopia.) Finally, the depth perception is investigated and retrained with stereograms. Eleven patients are described. They had strabismus with or without abnormal correspondence, and were definitely helped by orthofusor training. (Bibliography, 11 photographs.) Edward Saskin.

Santoro, Nicola. Tuerk's syndrome associated with Marcus Gunn phenomenon. *Riv. Oto-Neuro-Oft.*, 1941, v. 18, no. 4, pp. 300-311.

A 13-year-old girl had fibrous degeneration of her right external rectus muscle, that resulted in retraction of the right eye upon adduction, and made abduction of the right eye beyond the midline impossible. (Tuerk's syndrome). There was also ptosis of the right upper lid which could be raised only if the patient opened her mouth or performed chewing movements (Marcus Gunn phenomenon). The author does not believe that this rare combination of muscular disturbances was produced by a single pathogenetic factor. He prefers to explain the retraction phenomenon as a birth injury, and the jaw winking phenomenon by a mechanism of nervous synergy, the site of which he does not determine. (6 photographs.)

K. W. Ascher.

Spaeth, E. B. The Marcus Gunn phe-

nomenon. *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 143-158. (10 figures, references.)

5

CONJUNCTIVA

Aguilar, Jose. A case of resistant pneumococcus conjunctivitis. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Nov., p. 1001.

A pneumococcus conjunctivitis that had resisted all forms of local therapy for three months responded in a week to sulfathiazol compresses. The diagnosis and the cure were verified bacteriologically. Ray K. Daily.

Amat, M. M. A rare complication of vernal conjunctivitis. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Nov., pp. 994-1000.

A 41-year-old woman had central corneal ulcers of both eyes caused by the irritation of the excrescences of vernal conjunctivitis. In the left cornea the untreated ulcer led to corneal perforation. In the spring she had a dermatitis of the hands and face. Because of corneal ulceration the left eye was bandaged for a long time; this not only resulted in the healing of the corneal ulcer, but the conjunctival excrescences disappeared, and the conjunctiva assumed a normal appearance. The right eye, which remained open had at the same time a florid vernal catarrh. The author advocates the Blascovics operation in this disease. Ray K. Daily.

Baxter, C. R. Reiter's disease. *Brit. M. J.*, 1946, Dec. 7, p. 858.

A case of Reiter's disease is interesting because all of the symptoms except diarrhea and hematuria were exhibited and for the sequence of their appearance—conjunctivitis, urethritis, then

polyarthritis and keratoderma coincidentally, and a concomitant recurrent iritis that was preceded by intraocular hemorrhage. F. H. Haessler.

Bushmich, D. G. Tissue therapy of trachomatous pannus. *Oftal. Jour.* (Odessa), 1946, pt. 2, pp. 22-25.

This form of therapy was applied to trachomatous pannus by Filatov in 1936. Implantation of preserved cadaver mucous membrane from the lip and conjunctiva led to gratifying results. Later Filatov and his school tried implantation of preserved cadaver skin into the conjunctiva and in the skin of the temple, autotransplantation of preserved mucous membrane from the lip, implantation of preserved sclera on the eyeball, and subconjunctival implantation of preserved cartilage. The results were gratifying in all cases. Implantation of placenta and intramuscular injections of cod liver oil were included among the therapeutic procedures. Within recent years Filatov began to experiment with products of vegetation placed in unfavorable environment; he used principally an aqueous extract of leaves of aloes. Kalfa, in experimenting with this extract found considerable absorption of the infiltration of the lids after the subcutaneous injections of extract of aloes, and subcutaneous implantation of preserved skin in 32 patients. These procedures lead to a retrogression of pannus, increased transparency of the cornea, and a diminution of infiltration in the lids. There was no recurrence of the disease.

Ray K. Daily.

Cristini, Giuseppe. Concerning the histogenesis of benign conjunctival nevus. *Riv. di Oftalm.*, 1946, v. 1, May, pp. 319-342.

Three cases of benign conjunctival

nevus are discussed extensively, illustrated by two photographs and nine microphotographs. Every nevus of the conjunctiva seems to grow from a heterotypic vestige; this is also true for the dermoepithelioma described in this paper. (11 illustrations.)

K. W. Ascher.

Hayes, F. B., and Chamberlain, R. D. Meningococcal conjunctivitis. *U. S. Naval Med. Bull.*, 1946, v. 46, May, pp. 758-760.

A unilateral acute purulent conjunctivitis, with intra- and extracellular gram-negative diplococci is described. Shortly after the onset of the conjunctivitis, the patient developed purulent meningitis. Cultures revealed meningococcus type I in eye secretions and spinal fluid. The patient recovered after penicillin therapy. Benjamin Milder.

Kamel, S. Pterygium. Its nature and a new line of treatment. *Brit. Jour. Ophth.*, 1946, v. 30, Sept., pp. 549-563.

Histologic study of pterygium revealed the presence of an ordinary hyaline degeneration with much elastic connective tissue. Pterygium begins as a common exposure conjunctivitis. When the inflammation attacks the cornea, a chronic kerato-conjunctivitis results and a pterygium begins to form. Fibrous tissue is laid down in the area and when this contracts, it pulls a fold of loose conjunctiva toward the rigid cornea. The neoplastic and degenerative theories of the etiology of pterygium are untenable.

The McReynolds operation is followed by recurrence in 30 to 50 percent in Egypt. In inactive pterygium the author merely snips off the head of the growth. When a pterygium is active the head is shaved off, and the growth is undermined throughout its length.

but it is not dissected from the rest of the conjunctiva. After the undermining it is allowed to fall back into place. Its under surface is carefully cauterized with phenol and the eye is bandaged for a few days. The purpose of the undermining and the cautery is to destroy the fibrous bands which have pulled the fold toward the cornea. In 600 cases there has not been a single recurrence.

Morris Kaplan.

Lavery, F. S. Sulphonamides and penicillin in the treatment of trachoma. *Brit. Jour. Ophth.*, 1946, v. 30, Oct., pp. 591-594.

End results of 13 cases of proven trachoma treated with sulphonamides and with penicillin are tabulated. Eight patients were given a sulfonamide for trachoma and five were treated with penicillin. In each group inclusion bodies persisted in four patients.

Morris Kaplan.

Lopez, P. M. The forms, types, and therapy of simple superficial chronic conjunctivitis. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Nov., pp. 981-993.

For proper treatment of chronic conjunctivitis it is necessary to make a thorough ocular and general examination. Diseases of the lacrimal apparatus, Meibomitis, errors of refraction, toxic products originating from disturbances of the various organs, and allergy may be etiologic factors. For local therapy he prefers superficial scarification of the cornea followed by the application of alum or copper sulphate pencil. This is followed by the usual colyria and ointments. Diaphanoscopy is urged for the examination of the Meibomian glands, which are a frequent source of chronic conjunctivitis.

Ray K. Daily.

Miller, A. R., and Blower, D. E. Primary diphtheria of the conjunctiva. *Lancet*, 1946, v. 2, Sept. 7, pp. 345-346.

Two cases of primary diphtheria of the conjunctiva are reported by the authors. The first, in a girl, three years of age, manifested itself by nasal and conjunctival discharge. Diphtheria bacilli were found in the eye secretions only. Antitoxin cured the patient promptly. The second case occurred in this child's five-year-old brother.

Francis M. Crage.

Moretti, Ezio. Etiology and treatment of trachoma. *Rassegna Ital. d'Ottal.*, 1941, v. 10, March-April, p. 224.

Moretti feels that there is no specific cause of trachoma, but that the disease is a focal reaction to many pathogens. He relates his experience with cutaneous tests and treatment with "esotuberculina" of Finzi. In four patients there were definite positive reactions and improvement with the injections of tuberculin.

E. M. Blake.

Sammis, A. W. Ophthalmic disease treated with penicillin. *U. S. Naval Med. Bull.*, 1946, v. 46, June, pp. 912-915.

Two case reports are presented. A severe gonorrheal conjunctivitis cleared in four days after the combined use of intra-muscular and topical penicillin. In the second patient, a persistent chronic conjunctivitis, of two months duration, was cured in six days by the same therapeutic program.

Benjamin Milder.

Simonelli, Mario. Generalized neurofibromatosis (Recklinghausen's disease) with conjunctival involvement. *Riv. Oto-Neuro-Oft.*, 1941, v. 18, Sept.-Oct., pp. 435-445.

Conjunctival localization of Reckling-

hausen's disease is rare; the author added his own observation to the thirteen cases described in the literature. (5 photographs, 4 photomicrographs.)

K. W. Ascher.

Sironi, L. Epithelioma of limbus at the site of a keratosis of the conjunctiva. *Rassegna Ital. d'Ottal.*, 1941, v. 10, May-June, p. 281.

A small tumor at the limbus recurred twice after removal in a 44-year-old patient. No recurrence or metastasis was observed two years after complete removal. Histologically the tumor was an epithelioma of the Malpighian type, developing at the site of a hyperkeratosis of the limbus (tyloma). The author considers the hyperkeratosis a precancerous lesion. (11 figs.)

E. M. Blake.

Umiker, W., and Crofoot, M. Stevens-Johnson disease. *U. S. Naval Med. Bull.*, 1946, v. 46, Sept., pp. 1466-69.

Stevens-Johnson disease, a syndrome of conjunctivitis, stomatitis and dermatitis, is related to erythema multiforme. The conjunctivitis may be severe and there is a painful ulcerative stomatitis. Recovery is spontaneous, and there is no specific treatment. In the case reported, the patient was acutely ill, and in addition to the triad mentioned above, he had balanitis. Penicillin therapy and parenteral amino acids were given. Recovery was complete in five weeks.

Benjamin Milder.

Vancea, P. The electrometric variations of the tissue pH in trachoma. *Revue Bulgare d'Opht.*, 1943, v. 2, pp. 167-160.

The virus of trachoma causes a considerable acidification of the conjunctival tissue which, nevertheless, returns

to normal as soon as the trachomatous lesion clears up. Alice R. Deutsch.

Verzella, Mario. Types of variants of epibulbar epithelioma. *Riv. di Oftalm.*, 1946, v. 1, June, pp. 409-425.

Two cases are described extensively, and nine microphotographs presented. One patient had an atypical epithelioma of high malignancy with rapidly spreading metastases which led to the fatal end; the other, with a conjunctival tyloma, had no local recurrency nor metastasis after an observation period of 2½ years. (Bibliography.)

K. W. Ascher.

6

CORNEA AND SCLERA

Bassi, G., and Jona, S. The ocular manifestations in human alactoflavinosis. *Boll. d'Ocul.*, 1945, v. 24, Jan.-March, pp. 3-18.

A boy, 12 years of age, had poor vision as long as he could remember. His vision was 1/10 in each eye. The biomicroscopic examination showed a pericorneal injection and most extensive vascularization of the entire cornea. Intense photophobia and lacrimation existed. The condition of the eyes improved after treatment with lactoflavin. After a long discussion the writer concludes that the presence of such general manifestations as glossoptrophy and goniostomatopathy and the good result obtained from the specific treatment justify the diagnosis, namely alactoflavinosis. (6 illustrations, references.)

Melchior Lombardo.

Bonnet, P. A diffuse hyperplastic papillomatous tumor of the cornea originating from an old pannus. *Revue Bulgare d'Opht.*, 1943, v. 2, pp. 44-54.

The author reports the clinical and

pathological description of a papillomatous growth in a cornea, in an eye with trachomatous pannus. He discusses the possible treatment and prefers temporary blepharoraphy to any other treatment. (4 figures.)

Alice R. Deutsch.

Bowles, L. L., Allen, L., Sydenstricker, V., Hock, C., and Hall, W. The development and demonstration of corneal vascularization in rats deficient in vitamin A and in riboflavin. *J. Nutrition*, 1946, v. 32, July, pp. 19-35.

About 500 Wistar strain rats were used in this study. Some were placed on riboflavin and others on vitamin A deficient diets. The corneas were studied after the ascending aortas had been injected with 5 ml. of india ink.

In riboflavin deficiency conjunctival edema and congestion, usually with photophobia, was the first ocular change, followed after a week by marked congestion of the limbal vessels and occasionally by faint nebula. Soon thereafter capillary "sprouts" began to invade the cornea, in 60 percent from the superior nasal quadrant, in 20 percent from the 12-o'clock meridian above, and in 20 percent from the superior temporal quadrant. A few days later, intense edema and corneal opacification occurred, which obscured the progress of the vascularization. This subsided after one or two weeks, when the cornea was heavily vascularized, often with anastomoses in the central portion. The pattern was more of the terminal loop type and less of the dendritic. This vascularization was relatively easily distinguished from the spontaneous vascularization that was found in 4 of the 500 rats.

In vitamin A deficiency, conjunctival edema and congestion with photophobia, occurred first, then xerophthal-

mia, with an opaque and partially desquamated cornea. Three to seven days later the cornea was diffusely opacified, and capillaries were seen peripherally, usually of the dendritic type, which formed a dense peripheral band. Then edema and leukocytic infiltration often progressed so that the vessels became invisible. (2 plates, 12 figures, references.)

Bennett W. Muir.

Cantuliera, J. A. Herpetic keratitis. Report of cases. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Sept., pp. 776-790.

A review of the literature on the etiology and therapy of herpetic keratitis is presented. Two cases of dendritic keratitis and two of superficial punctate keratitis treated with satisfactory results with vitamin B₁ are reported.

Ray K. Daily.

Cavara, Vittoriano. Severe and severest types of herpetic keratitis. *Revue Bulgare d'Ophth.*, 1943, v. 2, pp. 65-73.

After a short review of the classic forms of herpetic keratitis and related types the author describes observations of his own with especial emphasis on two eyes with dense corneal infiltrations of insidious onset which because of their herpeticiform fluorescein staining, loss of corneal surface sensitivity, and intensive neuralgic pain were considered herpetic in origin. He draws attention to the fact that a severe keratitis of unknown etiology may be herpetic. (References.)

Alice R. Deutsch.

Colombo, Gianluigi. Cases of epidemic nummular keratoconjunctivitis in Milan. *Boll. d'Ocul.*, 1946, v. 25, Jan.-June, pp. 297-302.

The writer reports three cases of this affection in members of the same fami-

ly. The patients, two adult women and a man, were treated with sulfathiazole preparations, zinc sulphate, mydriatics and vitamin B₁ with improvement of the conjunctival symptoms but with no marked effect on the corneal symptoms which had began two weeks after the beginning of the affection and two months later were still present. Probably an ultravirus is the causative agent of the disease. In 40 percent the symptoms are limited to the conjunctiva. The disease manifests itself in cold and damp periods, affects adults and can be unilateral. There may be preauricular adenitis, photophobia, catarrhal exudation and all other symptoms of acute conjunctivitis. The corneal manifestations begin with small round numerous grayish infiltrations situated mostly in the pupillary zone. The epithelium remains intact, the corneal sensibility is slightly diminished, and no marked pericorneal injection is visible. The vision is affected greatly. The writer gives a differential diagnosis from other types of conjunctivitis and keratitis. Melchior Lombardo.

Dejean, C., and Sedan, J. A clinical and experimental study of corneal lesions caused by indelible pencil and their treatment. *Revue Bulgare d'Opht.*, 1943, v. 2, pp. 75-83.

Corneal injuries caused by indelible pencils may cause aseptic necrosis. The basic colors are more dangerous than the acid dyes because they penetrate faster and have a selective affinity for the nuclei of the cells.

Two clinical observations and fourteen experimental lesions in guinea pigs are described to demonstrate the necrotizing action of aniline dyes. Deep corneal ulcers and a widespread interstitial keratitis occur in untreated eyes. A thorough and immediate mechanical

cleaning of the wound, followed by lavage with 95-percent alcohol, considerably improve an otherwise unfavorable outcome. Alice R. Deutsch.

Ershkovich, I. G. Keratoplasty in complicated leucomas, following war-injuries. *Oftal. Jour. (Odessa)*, 1946, pt. 2, pp. 18-21.

Keratoplasty in war injuries is not widely used, because of the severe injuries of the ocular tissues and because of the density of the leucomata. Ocular perforations, which form the greatest number of injuries, were inflicted principally by mine fragments, and along with corneal destruction produced havoc in the deeper structures of the eye. The results of such damage are dense large leucomas, matted with the iris, and with dense cicatricial membranes behind. There is frequently an organized exudate in the anterior chamber. The lens is opaque or partially absorbed. The deeper changes are obscured by the cloudy media, but usually there is organized exudate in the vitreous, traumatic chorioretinitis, proliferative retinitis, optic atrophy, and sometimes retinal detachment. In addition there is frequently flattening of the leucoma or of the entire anterior ocular segment, ectasia of the leucoma, and secondary glaucoma. Such eyes are not considered suitable for keratoplasty. Occasionally, however, keratoplasty in combination with other operations and with persistent tissue therapy may bring about significant visual improvement, which liberates the patient from invalidism, and may even restore a degree of vocational competence. He urges that the surgical indications be extended, and that patients with corneal scars be given the benefit of persistent therapy even in the presence of synechia, cicatricial membranes, vitre-

ous opacities and changes in the fundus. (2 illustrations.) Ray K. Daily.

Filatov, V. P. *Perspectives in keratoplasty*. Vestnik Oft., 1946, v. 25, pt. 1, pp. 34-38.

Filatov credits priority in keratoplasty to FIRM and Elschning, and claims as his own contribution simplification of technic and utilization of cadaver cornea. On the basis of his experience with over 1,000 eyes he outlines a series of problems under investigation. The most unmanageable complication in keratoplasty is glaucoma, and one of the great needs is an effective antiglaucomatous operation. Improving the transparency of the graft and the biologic conditions of the leucoma is accomplished best by superficial corneal grafts combined with tissue therapy. Removing the opaque anterior corneal layers sometimes gives very satisfactory results, particularly if combined with tissue therapy. The transplantation of the entire cornea for staphylococcal infection is only in its initial stage of investigation. The correlation between the microscopic picture of the leucoma and the results of keratoplasty, and on the optimal period of preservation of cadaver eyes is being studied. Keratoplasty in war-injured eyes is not satisfactory, and studies should be made to determine the optimal period of surgery, the preoperative preparation, and the reaction of traumatized eyes. The possibilities of heteroplasty are indicated by the work of Petrociantz, who succeeded with transplantation of dog cornea on cats. Seltzer's and Sherehevski's work with transplantation of cornea preserved in formalin needs further investigation. The chaotic reports of keratoplasty do not permit an accurate evaluation of the surgical procedures. Filatov urges that corneal

leucomas be classified according to their extent and density, and that the surgical results be carefully recorded in relation to the state of the corneal leucoma. The comparison of opacities following interstitial keratitis with dense corneal leucomas obviously leads to confusion. Ray K. Daily.

Gardiner, P. A. *Corneal vascularization in chronic disease*. Brit. Jour Ophth., 1946, v. 30, Oct., pp. 581-589.

In view of the frequent appearance of corneal vascularization in deficiency diseases 191 patients with duodenal ulcer, rheumatoid arthritis and fibrositis, skin diseases, osteo-arthritis, and some other gastro-intestinal diseases were studied and compared with a control group of healthy persons and persons who had trivial illness. It was shown that the more severe the disease, the more vascular the cornea. However, some vascularisation, often marked, was found in persons with trivial illness. None was found in healthy subjects nor in patients with diseases of functional origin. Possibly the phenomenon could be used to differentiate organic from functional diseases. (5 tables.) Morris Kaplan.

Girones, E. A. *Keratitis punctata*. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, Sept., pp. 768-775.

A review of the literature, a description of the clinical symptoms, and a discussion of the etiology are presented. The cases seen by the author occurred after an epidemic of acute Koch-Weeks conjunctivitis and were in close relation to an epidemic of upper respiratory infection. Accumulated data on the identity of the Koch-Weeks and the influenza bacillus, suggest that possibly this bacillus is the cause of keratoconjunctivitis producing the inflammation

through the liberation of toxins or an ultravirus. Additional evidence to support this belief is the fact that grippe often begins with conjunctivitis, and that some patients with Koch-Weeks conjunctivitis have severe constitutional symptoms. The onset of the punctate keratitis is sudden, its evolution is slow, and therapy is of little avail. (6 illustrations.) Ray K. Daily.

Golovina, A. C. Keratoplasty in leucoma in veterans. *Vestnik Oft.*, 1946, v. 25, pt. 1, pp. 43-46.

Golovina reports six cases of keratoplasty in four veterans with severely injured eyes and extensive intraocular damage. Five eyes recovered some vision. Golovina attributes much importance to preoperative and postoperative tissue therapy. Ray K. Daily.

Gruber. Max. Cornea verticillata. (Second communication.) *Ophthalmologica*, 1946, v. 112, Aug., pp. 88-91.

To a previous report Gruber adds a second family in which cornea verticillata occurred, a condition first described by Fleischer. It was observed in both eyes of a woman, 56 years of age, and of one adult son, and daughter. It is probably an unusual hereditary variation of physiological character. The manner of transmission is not certain. (6 figures, 1 family tree, references.) F. Nelson.

Kinsey, V., and Grant, W. Determination of the rate of disappearance of mustard gas and mustard intermediates in corneal tissue. *J. Cl. Invest.*, 1946, v. 25, Sept., pp. 776-779.

The rate of disappearance of H (mustard gas) in corneas in vitro at 23 and 37 degrees centigrade was determined by analysis of cyclohexane-kerosene extracts. For these two temperatures, the half-life of H was found

to be approximately 13 and 3 minutes, and the over-all half-life of H and its monochloro hydrolysis product was 18½ and 4 minutes, all respectively.

The effect on corneal tissue was measured by subsequently determining inhibition of swelling of the corneal pieces when placed in water. It was found that the effect was proportional to the number of chlorides of both H and H hydrolysis intermediates available for replacement.

The findings indicate that therapeutic agents designed to react with H within tissues would be without benefit unless used within 3 to 5 minutes after contact with the vesicant.

Theodore M. Shapira.

Lohlein, Walter. Keratoplasties in keratoconus. *Revue Bulgare d'Ophth.*, 1943, v. 2, pp. 101-111.

Three successful keratoplasties in keratoconus are reported. The author discusses the special indications, difficulties and results of keratoplasties in this disease.

The avascularity of the cornea is an advantage for the operation. The ex-centric location of the tip of the conus and the thinning of the cornea make the operation more difficult. Early surgery and a large transplant (not smaller than 5 mm.) are recommended so that the whole thinned area is removed. A larger transplant increases the danger of irregular fitting and the formation of a fistula. Alice R. Deutsch.

Matteucci, P. Corneal lesions in Hodgkin's disease. *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 136-142. (2 figures, references.)

Mazzoletti, Giorgio. A case of familial degeneration of the cornea of the nodu-

lar type. *Rassegna Ital. d'Ottal.*, 1941, v. 10, March-April, p. 171.

A perforating keratoplasty was done on the right eye of a 66-year-old man whose vision was reduced to light perception in each eye. Microscopic examination showed disintegration of Bowman's membrane, hyperplasia of the epithelial cells with changes in the basal layer. The stroma presented an amorphous, granular substance, partially condensed into droplets. Differential staining showed that there were two kinds of substances with opposite reactions, which, however, did not correspond to the description of a basophilic stain below Bowman's membrane and an acidophilic stain in the epithelial cells. (2 figures and bibliography.)

E. M. Blake.

Roshchin, V. P. The biologic indicator in 124 cases of keratoplasty. *Vestnik Oft.*, 1946, v. 26, pt. 1, pp. 47-48.

The author presents an analysis of the correlation between the type of leucoma and the transparency of the graft in 124 cases of keratoplasty. In leucoma simplex a transparent graft was obtained in 60 percent of cases, in leucoma adherens in 38 percent, and in leucoma totale in 17.9 percent.

Ray K. Daily.

Samoilov, A. J., and Shivarova, E. D. The role of sensitivity of a leucoma in the transparency of the graft in keratoplasty. *Vestnik Oft.*, 1946, v. 25, p. 1, pp. 38-43.

The tabulated data show that corneal sensitivity, as an indication of the trophic condition of the cornea, was an important prognostic indicator of the final visual result in 20 cases of keratoplasty. The transparency of the grafts was in direct relation to the corneal sensitivity of the host. It is advisable

to increase the corneal nutrition and sensitivity preoperatively with physiotherapy and tissue therapy.

Ray K. Daily.

Smelser, G. K., and Ozanics, V. Effect of quick freezing at very low temperatures of donor tissue in corneal transplants. *Proc. Soc. Exper. Biol. and Med.*, 1946, v. 62, June, pp. 274-277.

To test the late results of frozen material as compared with living transplants, a series of corneal transplantations was done on rabbits. The corneas were frozen in isopentane, and transferred to liquid nitrogen, where they remained for one hour to four days. Not one of the operations was successful; all the transplants became opaque eventually. In a control series of 22 cases all eyes remained clear. The use of frozen tissue is no handicap in the technical details of the operation. (2 figures, references.)

Bennett W. Muir.

Sourdille, G. P. Technique of corneal grafts in man. *Arch. d'Ophth.*, 1946, v. 6, no. 3, pp. 273-283.

Sourdille reviews the various techniques in keratoplasty and discusses their advantages and disadvantages. He mentions the value of partial non-penetrating grafts in some cases as a preparation for the classical whole-thickness corneal graft and their value in the treatment of recurrent pterygium, lipidal degeneration, and dystrophies of the cornea. Penetrating grafts yield a satisfactory percentage of permanently clear grafts. He emphasizes the importance of technique in obtaining clear grafts and describes his own in detail. To obtain his grafts he uses an Elliot trephine with a diameter of 5 mm. and with the bevel on the out-

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Adamantiades, B. Thrombophlebitis as a fourth symptom of recurrent hypopyon iritis. *Ann. d'Ocul.*, 1946, v. 179, March, pp. 143-147.

A fourth symptom is added to the syndrome of Behcet (hypopyon iritis, ulcers of the mouth and ulcers of the genitals). Venous retinal hemorrhages caused by thrombophlebitis may precede the other elements of the syndrome, especially the hypopyon iritis. Thrombophlebitis may also exist in other parts of the body. The etiologic factors may be varied and multiple, with or without an allergic factor, and may be brucellosis, staphylococic septicemia, tuberculosis, and virus infections of unknown origin. The assumption of an allergic factor helps explain the periodicity, sudden onset, relatively short duration, and the coexistence of dermal erythema, and ulcers of the mouth and genitals. Recurrences have frequently followed exposure to cold. The ocular disease resembles a condition observed in horses. In the first case reported, the ocular condition was considered tuberculous and was treated with methylic antigen, and later with penicillin. Vision was totally lost in both eyes from recurrent attacks during four years. In the second patient thrombophlebitis of the lower extremities and retina accompanied the other units of this syndrome. (References.) Chas. A. Bahn.

Arruga, H. A case of essential atrophy of the iris. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, April, pp. 233-237.

Arruga reports a case of essential atrophy of the iris, in a woman 25 years

side. The trephine used for the recipient eye, however, is beveled on its inner face. He has not used mechanical trephines. To protect the iris and lens he has used the knife designed by Nicetic to make a double corneal section. Other instruments include large spatulas, narrow keratomes, and corneal scissors.

In preoperative preparation Sourdille stresses the importance of removing all sources of infection such as lacrimal disease or conjunctivitis. He recommends the coagulation of superficial vessels such as occur in phlyctenular keratitis or, if there is a pannus present, its removal by dissection. Iris adhesions, either to the cornea or to the lens, if extensive, should be removed by iridectomy or by synechotomy. Intraocular tension must be normal preoperatively. For anaesthesia he supplements topical applications of cocaine and adrenalin with retrobulbar injection of procaine. He holds the graft in place by means of a narrow strip of conjunctiva. The source of the graft is important and grafts from eyes with absolute glaucoma and traumatic corneal lesions should be avoided. Postoperative care includes binocular dressings for ten or twelve days, with the first dressing on the fourth or fifth day. The conjunctival strip is allowed to retract on the eighth or ninth day.

The main difficulties in the operation seem to result from poor trephines, from secondary glaucoma, from iris-lens adhesions, from vitreous in the anterior chamber, from secondary expulsion of the graft, and from necrosis of the graft. The author discusses these complications and their treatment. He concludes that in spite of them the operation yields a high percentage of satisfactory results.

Phillips Thygeson.

of age, with otherwise negative general and local findings. Reference is made to Zentmayer's and DeSchweinitz's cases which were similar to this case, and to Arnold's case, which terminated in glaucoma. (3 illustrations.)

Ray K. Daily.

Bothman, Louis. Allergic iritis. *Illinois M. J.*, 1946, v. 89, March, p. 124.

Bothman reviews the literature and reports six cases of iritis with presumptive evidence of allergic etiology. Repeated studies for focal infection were negative. Treatment with atrophine, fever, and calcium failed to prevent recurrences. All patients were highly allergic to several agents. All had involvement of the cornea with superficial infiltrates at one time or another. One has been under controlled treatment with no recurrences for six years.

John B. Hitz.

Bushard, W. J. Intraocular malignant melanomas of the choroid. *Minnesota Med.*, 1946, v. 29, Oct., pp. 1005-1007.

The subject is reviewed in brief. The symptomless stage, during which much valuable time so necessary in making an early and exact diagnosis is often lost, receives considerable attention. Most fortunate is the patient in whom the growth occupies the macular area. More often the late toxic signs of glaucoma or iridocyclitis arouse the patient, but the confusing picture may at least temporarily lead to the wrong diagnosis.

Three cases are presented by the author. In one an extensive bullous detachment settled down over a circumscribed elevated mass after a subconjunctival scleral puncture. Unilateral detachment, congestive glaucoma, iridocyclitis, disturbed central vision in

one eye without obvious explanation, and phthisical globes call for particular effort in determining presence or absence of intraocular neoplasm.

Francis M. Crage.

Carlevarlo, G. Bilateral ocular manifestations in the heterochromia of Fuchs. *Rassegna Ital. d'Oftal.*, 1941, v. 10, March-April, p. 203.

The author presents four cases of heterochromia iridis and points out that the characteristic changes—precipitates on the posterior corneal surface, partial disappearance of the pigment ring of the iris, and numerous lenticular opacities—are present not only in the heterochromic eye, but to a lesser degree in the other eye. Cataract extraction is not contraindicated and the histologic examination of one lens so studied disclosed nothing unusual. (1 figure.)

E. M. Blake.

Charlin Vicuña, Carlos. Tuberculin-sensitive iridocyclitis. *Arch. Chilenos de Oft.*, 1945, v. 2, Nov.-Dec., pp. 28-30.

Spectacular improvement of bilateral iridocyclitis occurred in a woman of 28 years who was treated with extremely minute doses of tuberculin weekly, 0.1 c.c. of a "34 zero" solution (see Torres Estrada, *Bol. del Hosp. Oft. de Ntra. Sra. de la Luz*, 1944, July-Dec., page 163; abstracted *Amer. Jour. Ophth.*, 1945, v. 28, p. 1063).

W. H. Crisp.

Cortes, Hernan. Ulcerated gumma of the iris. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Jan., pp. 56-58.

Cortes reports a case of gumma of the iris which healed with pupillary occlusion and cyclitic cataract. For cosmetic reasons, against medical advice, the patient insisted on a cataract extraction. The surgical result was a

vascularized scar with the iris drawn into the incision. Ray K. Daily.

Cristini, Giuseppe. Angioma of the choroid. *Riv. di Oftalm.*, 1946, v. 1, June, pp. 374-391.

The author reports a case of angioma of the choroid and discusses its differential diagnosis and pathogenesis. (8 photomicrographs.) K. W. Ascher.

Della Casa, Franz. A metastatic abscess in the anterior chamber in chronic osteomyelitis. *Ophthalmologica* 1946, v. 3, Feb.-March, pp. 152-155.

An abscess in the anterior chamber in a patient with osteomyelitis of the tibia and humerus is described. The hematogenous metastasis was apparently provoked by mild trauma. An embolus was probably located in the intrascleral plexus. (Colored plate.)

Alice R. Deutsch.

Diaz-Caneja, E. Tubercle of the choroid in tuberculous meningitis. *Arch de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, July, pp. 511-518.

Recent studies have demonstrated that choroidal tubercles are demonstrated in only 10 percent of patients with tuberculous meningitis.

J. W. McKinney.

Dominguez, D. D. Migrating ciliary nodules on the retina. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, March, pp. 265-268.

Von Szily's article on Wandertuberkel, published in the *Klin. Monats. f. Augenheil.* in 1931 is abstracted, reference is made to Krückmann's article on the subject, and one of these rare cases is reported. A woman, 62 years of age, with a bilateral iridocyclitis, was found to have in the lower periphery of both fundi two white slightly elevated foci,

which were regarded as foci of choroiditis. She recovered and returned two years later with an attack in the right eye. Fundus examination at this time revealed no trace of the former choroidal foci in the left eye. In the right eye were two fresh foci of choroiditis in a similar situation. They were nodular in structure, greyish-white, sharply circumscribed and projected definitely above the surface of the retina. One of them was located over a small retinal vessel. The situation of the nodules excluded the diagnosis of retinitis or choroiditis and they were diagnosed as nodules that were detached from the ciliary body and had become fixed on the retina. Dominguez does not agree with Szily that this form of propagation of a lesion of the ciliary body towards the posterior pole is limited to tuberculosis and believes that iridocyclitis of any etiology may extend in this manner. He therefore suggests that the designation of "migratory ciliary nodules," without etiologic commitments is a better term for this phenomenon.

Ray K. Daily.

Duthies, O. M. A case of congenital cyst of the iris. *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, pp. 244-247.

In a patient, 17 months of age, a congenital cyst of the iris was removed.

The lesion proved to be a simple cyst of myxomatous tissue lined by pigmented cells. Beulah Cushman.

Enciso, M. M. A sarcoidal sarcoma discovered incidentally. *Arch. de la Soc. Off. Hisp.-Amer.*, 1946, v. 6., Jan., pp. 64-68.

An eyeball enucleated with the diagnosis of subacute metastatic uveitis was found to contain a choroidal sarcoma as well as metastatic uveitis. The diagnosis was confirmed by histo-

logic examination. The author believes that the two affections were purely coincidental. (Photomicrograph.)

Ray K. Daily.

Espíldora Luque, C. Sympathetic ophthalmia consecutive to subconjunctival rupture of the sclera. *Arch. Chilenos de Oft.*, 1945, v. 2, Nov.-Dec., pp. 26-28.

A man of 33 years was struck in the right eye with a fist. The subconjunctival rupture of the sclera extended from the ciliary region for about a centimeter backward, in the upper outer region of the globe. There was no hernia of the uvea, nor any suggestion that the crystalline lens had been luxated subconjunctivally. The scleral gap was completely covered by conjunctiva. Total hyperemia prevented internal examination. Vision was reduced to perception of light, with poor projection. The patient disappeared 12 days after the injury, the eye in apparently good condition, although the vitreous was cloudy. Two months later he returned with vision reduced to shadows in the other eye, which had previously been normal. The clinical appearance was that of a sympathetic ophthalmia of the posterior type, but the author doubts whether it would have proved anatomically to be of this character. While undergoing study in the clinic, the patient died of acute yellow atrophy of the liver, and apparently the eyeball was not sectioned.

W. H. Crisp.

Figueiredo, N. P. de. Iritis secondary to dental abscess (and ? crystalloiditis). *Rev. Brasileira de Oft.*, 1946, v. 5, Sept., pp. 33-36.

In addition to iritis with whitish spots in the upper and lower angles of the anterior chamber (a sort of hypo-

pyon), there was an irregular pyriform formation almost filling the pupillary area and resting on the crystalline lens. This formation underwent resolution after removal of the tooth. (2 diagrams, references.)

W. H. Crisp.

Franceschetti, A. Rheumatic eye diseases. *Ophthalmologica*, 1946, v. 111, Apr.-May, pp. 242-269.

The author reviews the different forms of rheumatic disease and their ocular manifestations. He stresses the importance of ocular diagnosis for the classification of an accompanying joint lesion. Severe acute rheumatic disease rarely involves the eyes, but chronic progressive polyarthritis does. There is apparently no connection between arthritis deformans and iridocyclitis. An exact classification of joint disease, therefore, is an essential prognostic and therapeutic factor.

The clinical appearance of chronic polyarthritis is different in children than in adults. An insidious iridocyclitis with cataract and band-shaped keratitis speaks for a chronic polyarthritis in children, most often of the type Still. A serofibrinous surface iritis and a remarkably increased sedimentation rate favors the diagnosis of rheumatic or tuberculous disease in adults.

The different theories about the origin of rheumatic disease and the difficulties in diagnosis are mentioned. A description of the manifestations in the ocular tissues is given, as well as an outline for its treatment. (10 figures, references.)

Alice R. Deutsch.

Goldmann, H. The drainage of the aqueous in man. *Ophthalmologica*, 1946, v. 3, Feb.-March, pp. 146-154.

The appearance of two kinds of veins, one filled with clear fluid, the other with alternating stripes of fluid and

blood, the permanent location of those veins mostly on the nasal and temporal sides of the episclera, the pulsating current of the clear fluid and its increase in amount with pressure on the globe are signs of the constant drainage of the aqueous through Schlemm's canal into the episcleral veins. The pressure which the filtration-angle opposes is very low because the normal variation of the ocular tension is transmitted to the veins and is not lowered by passing through the filtration network. The difference in tension which regulates the outflow of the fluid must be very slight. The resistance of the angular network in the chamber angle must be insignificant and the height of the resistance occurs at the junction of Schlemm's canal and the finest episcleral veins. This clarifies the problem of the effectiveness of a very small iridectomy.

Alice R. Deutsch.

Guglienetti, Luigi. A melanosarcoma of the choroid with pigmentation of the vitreous. *Revue Bulgare d'Opht.*, 1943, v. 2, pp. 91-94.

The author describes the clinical and pathologic findings in an aphakic eye in which a melanosarcoma was found. An unusual finding was the diffuse pigmentation of an otherwise normal vitreous. The sector of the conjunctiva corresponding to the tumor was also very much infiltrated with pigment. There were no signs of perforation. The pigment in the vitreous consisted of black punctate masses, partly floating, partly adherent to the retina over the apex of the tumor. They were also seen with the slit-lamp.

Alice R. Deutsch.

Jona, Sergio. Clinical and biomicroscopic study of three cases of congenital, bilateral aniridia in the same fami-

ly. *Rassegna Ital. d'Ottal.*, 1941, v. 10, May-June, p. 303.

The three members affected with congenital bilateral aniridia were the mother and two daughters. One son was unaffected. Jona discusses the different theories as to the development of this anomaly. Concomitant changes are nystagmus, macrocornea, microcornea, marginal corneal opacity different from embryotoxon, congenital and acquired lens opacities, degeneration of the vitreous, and uncertain foveal reflex. An Elliot trephine in one eye failed to reduce the glaucoma and removal of the lens is recommended in similar cases.

In one patient, where the zonular fibers were visible, observations were made on the act of accommodation. (2 figures.)

E. M. Blake.

Klauder, J. V., and Dublin, G. J. Syphilitic uveitis. *Arch. of Ophth.*, 1946, v. 35, April, pp. 384-399.

This detailed article thoroughly discusses factors in diagnosis and treatment of this disease.

Syphilitic uveitis characteristically occurs in the secondary or late secondary stage of syphilis. The diagnosis is not difficult in patients in whom there is clinical evidence of early syphilis, a positive Wassermann reaction and prompt retrogression of the ocular inflammation after antisyphilitic treatment. The Herxheimer reaction in the uveal tract is described after arsenical and after penicillin therapy. This reaction was observed in 70 percent of the patients. The Herxheimer reaction is discussed from the standpoints of its diagnostic importance and from possible harm that might result from the reaction. Seventy-two cases of syphilitic uveitis are reported and the response to treatment studied. Prompt improvement occurred in patients

given chemotherapy. There was no special advantage noted in the use of fever therapy except as an initial treatment for very severe processes. In patients of this type initial reduced doses of a bismuth compound prior to injection of an arsenical serve the same purpose. Penicillin was used exclusively in seventeen patients with good results. (References.) John C. Long.

Lachman, R., and Pérez Chacón, E. Cured bilateral endogenous uveitis. *Rev. Oto-Neuro-Oft.*, 1946, v. 21, May-June, pp. 61-63.

An acute bilateral uveitis with miosis and hypopyon in the right eye developed in an individual with bronchopulmonary disease. He was given penicillin and atropine. The hypopyon disappeared in two to three days, but the miosis persisted. To help overcome this, ephedralin was injected subconjunctivally near the limbus of each eye in the 12-, 3-, 6-, and 9-o'clock positions. This resulted first in irregular mydriasis, and an improved visual acuity. Within a day both pupils were dilated uniformly. On the ninth day of treatment penicillin was stopped. After two weeks vision had improved from light perception to 10/10. (Bibliography.)

Edward Saskin.

Laval, Joseph. Spontaneous cyst of the iris. *Amer. Jour. Ophth.*, 1947, v. 30, Jan., pp. 55-57. (2 figures.)

Legroux. A case of sympathetic neuropapillitis. *Arch. d'Ophth.*, 1946, v. 6, no. 1, pp. 43-45.

The author presents the case of a boy, 15 years of age, who developed sympathetic ophthalmia, limited to the posterior segment, 22 days after a foreign body penetrated and destroyed

the sight of the inciting eye. When first seen the vision of the sympathizing eye was 1/10 and a central scotoma was present. Fundus examination revealed an optic neuritis; there were no signs of iris or ciliary body involvement. Enucleation of the inciting eye was performed immediately. A daily dose of six grams of Rubiazol was given for six days. The visual acuity began to rise after the second day and in three weeks had become 6/10. At the same time, however, the edema of the optic nerve and retina increased and at the end of another month the vision had fallen back to 2/10. In addition to a central scotoma, peripheral field constriction developed. Treatment in the following weeks consisted in trepanation of the right sphenoid sinus, a second course of sulfonamides, and finally a course of sodium salicylate. By the end of the ninth month the visual fields had become normal and vision remained stationary at 4.5/10. The fundus had returned to normal except for a slight blurring of the disc margin. The author makes a plea for prophylactic removal of badly damaged eyes.

Phillips Thygeson.

Levine, M., and Gordon, M. Ocular tumors with exophthalmia in xiphophorine fishes. *Cancer Research*, 1946, v. 6, April, p. 197.

The authors report that in four of 500 aquaria (all under the same dietary and environmental influence) they found xiphophorine (swordtail) fishes who showed unilateral or bilateral exophthalmos. Histopathologic study revealed a malignant choroid tumor composed predominantly of epithelioid cells, that resembled the malignant melanomas of the human eye. The etiology of these tumors is unknown,

and their occurrence cannot be explained genetically in Mendelian terms.
Benjamin Milder.

Lijo Pavia, J., and Lachman, R. **Congenital aniridia. Three observations.** *Rev. Asoc. med. Argent.*, 1946, v. 60, April, pp. 179-181.

The authors report three cases of aniridia. The first patient had a total bilateral aniridia associated with zonular opacities and posterior polar cataract in the left eye; the second had an incomplete bilateral aniridia associated with pseudoptosis; and the last an incomplete congenital unilateral aniridia associated with a pseudoptosis. (2 pictures and a brief bibliography.)

Jose Saenz Canales.

McArevey, J. B. **Sympathetic ophthalmitis.** *Trans. Ophth. Soc. U. Kingdom*, 1944, v. 64, pp. 300-304.

The author emphasizes that operations on secondary cataracts should be avoided. A careful preoperative examination of all eyes with the slitlamp will discover a low grade uveitis. He recommends the removal of an injured eye which suddenly shows fine bedewing of the posterior endothelium or when the clinical appearance of continued irritation persists despite treatment.

During the year 1943 at the Royal Victoria Eye & Ear Hospital, Dublin, 50 eyes were removed after perforating injuries, 20 were examined and in 12 of these sympathetic disease was present. In two patients the second eye had become affected. The shortest intervals of time between injury and enucleation in 10 cases of sympathetic ophthalmia were 9, 12, 17 and 21 days and two of the patients had had injuries for two years before the eyes were enucleated.

Beulah Cushman.

Meesman, A. **A contribution to the pathogenesis of postoperative choroidal detachment.** *Revue Bulgare d'Opht.*, 1943, v. 2, pp. 137-150.

The origin of the postoperative choroidal detachment is discussed.

The author's own experiments consisted of ligations of the vortex veins in rabbits to determine whether a stagnation hyperemia in the choroid with normal or subnormal tension could cause a choroidal detachment. The dilatation of the uveal vessels was considerable but the vitreous did not yield, or shrink, or shift towards the anterior parts of the eye. A choroidal detachment only occurred after paracentesis with a resulting advancement of the iris-lens-diaphragm.

Alice R. Deutsch.

Mosquera, Sanchez. **The separation of iridocapsulary synechia.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Sept., p. 806.

The author emphasizes the value of massage in the separation of fresh synechiae which are resistant to the instillation of a mydriatic.

Ray K. Daily.

Picena, J. P., and Paez Allende, F. **Achromic choroidal melanoma.** *Anales Argentinos de Oft.*, 1946, v. 7, April-May-June, pp. 39-47.

Although the great majority of choroidal sarcomas are melanotic, occasionally a leucosarcoma is observed. An 80-year-old woman had a pale gray tumor at the posterior pole of the right eye. Acute glaucoma supervened and necessitated enucleation. Histologic study of the eye revealed neoplastic sarcomatous tissue with rosettes, and special staining showed the presence of melanoblasts. (Bibliography.)

Edward Saskin.

Reed, H. Etiology of iridocyclitis in the African. *Brit. Jour. Ophth.*, 1946, v. 30, June, pp. 324-337.

In Lake Province, Tanganyika Territory of Africa, 42 cases of iridocyclitis were seen. Only 28 patients could be kept in the hospital for complete study. Except for slitlamp examination and some elaborate laboratory studies the investigation was complete. The study was materially hampered by the general preference for the witch doctor's regimen. There were 20 positive Kahn reactions, 8 patients had gonorrhea, 3 relapsing fever, 10 dental sepsis, 9 malaria, 9 schistosomiasis, 8 ankylostomiasis, and 2 taeniasis. The author concludes that the incidence of iridocyclitis in a tropical community is an index of the extent to which it is disease-ridden.

Morris Kaplan.

Rubino, A., and Corazza, G. Uveo-meningitic syndrome. *Riv. Oto-Neuro-Oft.*, 1941, v. 18, no. 3, pp. 177-198.

The authors describe the first case of Harada's disease observed in Italy. A benign lymphocytic meningitis was accompanied by a very severe uveitis, which reduced visual acuity of both eyes to finger counting. Two months later, the retinas were reattached, and large areas of depigmentation were found in both fundi surrounding the discs which again had an almost normal appearance. Slight increase of intraocular pressure was due to remnants of synechiae; final vision was 0.3 and 0.2 respectively. A filterable virus was assumed to be responsible for both the meningeal and the uveal lesions.

K. W. Ascher.

von Sallmann, L., and Di-Grandi, J. Hydrogen ion concentration of the aqueous. *Arch. of Ophth.*, 1946, v. 35, June, pp. 643-654.

A capillary glass electrode was designed to determine the hydrogen ion concentration of the aqueous of rabbits in vitro and in vivo. This technique eliminated many of the errors present in earlier methods. The observers found that the average physiologic pH of the rabbit aqueous was 7.53 with brief local anesthesia and between 7.44 and 7.49 in the initial stage of systemic anesthesia. Exogenous infections of the vitreous with *Staphylococcus aureus* caused a moderate shift of the hydrogen ion concentration of the aqueous to the acid side. A diet rich in alkali, an increase in the protein of the aqueous, and the iontophoretic introduction of anions had no noticeable effect on the pH of the aqueous. (References.)

John C. Long.

Sorsby, A. and Gormaz, A. Iritis in rheumatic affections. *Brit. M. J.*, 1946, April 20, pp. 597-600.

In an attempt to assess the frequency of iritis in the rheumatic affections, 815 patients suffering from the various forms of rheumatism were examined for evidence of active or past iritis and compared with those of a control series. Iritis was observed in 3 of 123 patients with osteoarthritis, in 3 of 53 patients with ankylosing spondylitis in 15 of 332 patients with rheumatoid arthritis and never in 313 patients with other forms of rheumatoid disease. The iritis in rheumatoid arthritis was usually mild, unilateral and recurrent. The inflammatory reactions in the eye and the joint are similar in that they are both ascribed to indirect bacterial activity. The literature is reviewed. It shows little appreciation of the frequency of iritis in rheumatoid arthritis. (References.)

I. E. Gaynon.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. Robert Gewanter, Long Island City, New York, died November 10, 1946, aged 44 years.

Dr. Matthew Gerard Golden, Brooklyn, New York, died November 11, 1946, aged 52 years.

Dr. Carl Miller Sneed, Columbia, Missouri, died November 6, 1946, aged 69 years.

MISCELLANEOUS

BOOKS AND WORLD RECOVERY

The desperate and continued need for American publications to serve as tools of physical and intellectual reconstruction abroad has been made vividly apparent by appeals from scholars in many lands. The American Book Center for War Devastated Libraries has been urged to continue meeting this need at least through 1947. The Book Center is therefore making a renewed appeal for American books and periodicals—for technical and scholarly books and periodicals in all fields and particularly for publications of the past ten years. We shall especially welcome complete or incomplete files of the *American Journal of Ophthalmology*.

The generous support which has been given to the Book Center has made it possible to ship more than 700,000 volumes abroad in the past year. It is hoped to double this amount before the Book Center closes. The books and periodicals which your personal or institutional library can spare are urgently needed and will help in the reconstruction which must preface world understanding and peace.

Ship your contributions to the American Book Center, c/o The Library of Congress, Washington 25, D.C. freight prepaid, or write to the Center for further information.

SOCIETIES

MEMBERSHIP THESIS

At the February 25th meeting of the Milwaukee Oto-Ophthalmic Society, Dr. George Dunker presented his thesis for membership. His subject was, "Report on a Series of 18 Cases of Acute Infectious Pseudomembranous Diplobacillary Conjunctivitis."

WILMER RESIDENTS ASSOCIATION

The sixth annual meeting of the Wilmer Institute Residents Association was held at

the Johns Hopkins Hospital in Baltimore, April 17th to 19th.

PAN-AMERICAN CONGRESS

Those who expect to attend the Pan-American Congress in Havana January 4 through January 10, 1948, should send their names to Dr. Tomas R. Yanes, P.O. Box 970, Havana, Cuba. The Sociedad Cubana de Oftalmologia has ratified the powers conferred in Montevideo upon Dr. Yanes, who will act as president of the local committee, assisted by members of the Cuban society.

SOUTHWESTERN MEDICAL FOUNDATION

The Southwestern Medical Foundation gave a dinner at Dallas, Texas, on February 28th in honor of Dr. Edward Henry Cary on the anniversary of his 75th birthday.

ATOMIC ENERGY IN MEDICINE

At the February meeting of the Reading Eye, Ear, Nose, and Throat Society held jointly with the Diplomates Association of Berks County Physicians, Dr. Eugene P. Pendergrass spoke on "Atomic Energy in Medicine."

HOLLAND PHYSICIAN SPEAKS

At the January meeting of the Cleveland Ophthalmological Club, Dr. John A. Van Heuven of Utrecht, Holland, was the guest speaker. He gave a most enlightening and interesting paper on "Retinal Detachment." Following his formal paper, Dr. Van Heuven spoke informally on his experiences with the medical division of the underground in Holland.

ANNOUNCEMENTS

HOME STUDY COURSES

The Home Study Courses, sponsored by the American Academy of Ophthalmology and Otolaryngology, in the basic sciences of those two specialties, will be given again, beginning September 1, 1947. Registrations must be completed before August 15th. Detailed information may be obtained from Dr. William L. Benedict, executive secretary, 100 First Avenue Building, Rochester, Minnesota.

OPTICAL AIDS FOR SUBNORMAL VISION

The Committee on Sensory Devices of the National Research Council has available a limited number of reprints of a condensation

of a "Report on a Survey of Optical Aids for Subnormal Vision," by V. S. Ellerbrock, recently published in the *Journal of the Optical Society of America*. There are also available a limited number of copies of the original unabridged report. This report, which was prepared to guide the committee in formulating a program of research, deals with the theory and practical aspects of telescopic spectacles, loupes, reading-glass magnifiers, and projection systems, as well as with recommendations for possible improvements in these devices. Copies of either of these reports will be mailed to professionally interested persons on request to the: Dartmouth Eye Institute, 4 Webster Avenue, Hanover, New Hampshire.

WILDER MEMORIAL LECTURE

Dr. John Q. Griffith, Jr., Laboratory for the Study of Hypertension, Philadelphia, will deliver the third William Hamlin Wilder Memorial Lecture of the Institute of Medicine of Chicago on Friday evening, May 23rd, at the Palmer House. His subject will be, "Rutin: A Therapy for the Hemorrhagic Complications of Hypertension."

EXAMINATIONS FOR TECHNICIANS

The next examination by the American Orthoptic Council will be held in September-October, 1947.

The written examinations will be held at

various cities in the country on Friday, September 12, 1947. Only those passing the written examinations will be permitted to take the oral and practical tests, to be given in Chicago, Saturday, October 11, 1947.

Applications on official forms must be received before July 1, 1947. Address the American Orthoptic Council, 23 East 79th Street, New York 21, New York.

PERSONALS

Dr. Franklin M. Foote, New York, has been named medical director of the National Society for the Prevention of Blindness. Dr. Foote formerly was chief of the Division of Local Health Administration, Connecticut State Department of Health, and is now assistant professor of Public Health in Preventive Medicine, Cornell University Medical College.

Leon S. Stone, Ph.D., Bronson professor of Comparative Anatomy, Yale University School of Medicine, New Haven, will receive the Robert W. Doyne Memorial Medal, an annual award of the Oxford Ophthalmological Congress in England. Dr. Stone, who will go to England next summer to address the Congress at Keeble College, Oxford, was given the award in recognition of his work on retinal regeneration and vision experiments in transplanted eyes.

Erratum

On page 282 of the March, 1947, issue of the JOURNAL, in the first column, last line of the first paragraph, "45 to 50 mm. wide" should read "45 to 50 μ . wide."

PIGMENTED TUMORS*

THE DE SCHWEINITZ LECTURE

ALGERNON B. REESE, M.D.

New York

GENERAL CONSIDERATIONS

Cells that produce pigment are called melanoblasts, and the pigment they produce is called melanin. Actually, we know very little about these cells and their product. For this reason, there is great difference of opinion regarding them, and those who are close to the subject and have given it a great deal of thought are reluctant to express definite concepts. Knowing full well that the whole subject is in a state of flux, and having already qualified myself to speak freely on the ground that those who know most about it will not, I shall attempt to outline the frontiers of the subject as I see them on the basis of our present knowledge. My approach will be from the neoplastic standpoint, and in this regard ophthalmologists have a great deal at stake, for their work embraces every type of pigment-bearing tumor.

The term "melanin" is a general non-specific one applied to almost any black, brown to tan pigment. It probably includes a heterogeneous group of pigments which have the common characteristic of absorbing visible light in a somewhat uniform manner.

Morphologically the melanin pigments encountered in the eye differ. That seen in the pigment epithelium of the retina is black and composed of discrete rods, while that in the chromatoblasts of the uvea is light and appears as varying-sized, amorphous, crystalline granules. It is quite possible that it will be shown some day that the melanins produced by various types of melanoblasts differ chemically, in staining reactions, in spectral absorption, or in other ways.

It has been established, mainly through the work of Bloch,¹ that melanoblasts contain an oxidase which is specific for oxidizing "dopa" into a substance resembling melanin. According to Laidlaw,² this oxidase is increased wherever melanin is being produced and is the invariable precursor of melanin. Where there is no melanin produced there is no oxidase, and where there is no oxidase no melanin is produced. The oxidase appears first and melanin next and the order is never reversed. The oxidase appears in the cell sometimes before the resultant melanin is visible, and the melanin itself may remain in the cell long after the oxidase has disappeared. As Bloch³ has pointed out, the cells around the growing margin of a malignant melanoma are more apt to contain the oxidase than those in the supposedly less-active cells in the center.

It appears, therefore, that access to this oxidase is essential for a cell to fabricate

*Delivered before the Section on Ophthalmology of the College of Physicians, Philadelphia, November 21, 1946. From the Institute of Ophthalmology of the Presbyterian Hospital, New York City, and the Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York City.

melanin. It is not known whether or not the oxidase is found in the cell itself or comes from some source outside of the cell, or whether or not it acts upon the cell causing the cell to synthesize melanin, or merely promotes the conversion of a leukomelanin or premelanin substance in the protoplasm to melanin. It seems, however, that, when this oxidase is available, many cells have the potentialities of showing melanin in their protoplasm.

Sometimes a malignant melanoma is associated with generalized melanosis in which pigment is seen in the connective tissue and reticulo-endothelial cells and, rarely, everywhere over the body including the endothelium of blood vessels, and even in the parenchymal cells of organs such as the kidney and the thyroid. The question of whether this is a result of phagocytosis of pigment dispersed from the primary site of the tumor must be considered, but it seems probable in some instances that the cells have stepped out of their usual role and become true melanoblasts. Time may prove, therefore, that any cell can fabricate melanin in its protoplasm if the necessary ferment is available, and that certain cells are usually melanoblasts because this ferment is available. Its availability may evolve around the peripheral sensory nerves.

The fact that this oxidase is available and even elaborated by a pigment-producing growth leads to changes in the tissues which may be confusing both histologically and clinically. Histologically, the cells composing the tissue harboring the tumor may be converted into melanoblasts, thus clouding the histologic picture in that the cells belonging to the tumor proper may be confused with those cells belonging to the stromal elements or to the host tissue. Clinically, the elaboration of oxidase by the tumor may be significant because it serves to explain the melanosis of the tissue adjacent to the

tumor or of the tissues which come into contact with the tumor. Clinical observations which bear this out are the following:

1. A nevus of the caruncle may give rise to a melanosis of the skin covering the adjacent canaliculi which come in contact with the tumor surface. Aside from the melanosis the skin is normal in appearance.

2. The conjunctiva adjacent to a nevus may show the melanosis and no other appreciable change. This may also be true of the corneal epithelium adjacent to a nevus of the limbus.

3. In an actively growing malignant melanoma of the skin or conjunctiva, the pigment halo of the adjacent skin or conjunctiva is not uncommon.

4. The café-au-lait pigmentation of the skin over the site of neurofibromatosis is a pigmentation of the basal layer of an otherwise normal skin.

5. When a nevus involves the lid margin, there may be a melanosis and even an epithelial hypertrophy of the margin of the other lid at the site where the nevus comes in contact with it.

6. Benign pigmented lesions sometimes occur on the iris in eyes harboring a malignant melanoma elsewhere in the uvea.

The appreciation of the nature of this melanosis of the tissues adjacent to, or in contact with, a pigmented lesion may assume clinical significance when such lesions are being excised. A simple melanosis, which is secondary to the product elaborated by the neoplasm, does not have to be included in the excision. This is important when the inclusion of such melanosis in the excision entails extensive plastic repairs and the sacrifice of important structures.

The process of oxidation is responsible for the appearance of melanin in the pro-

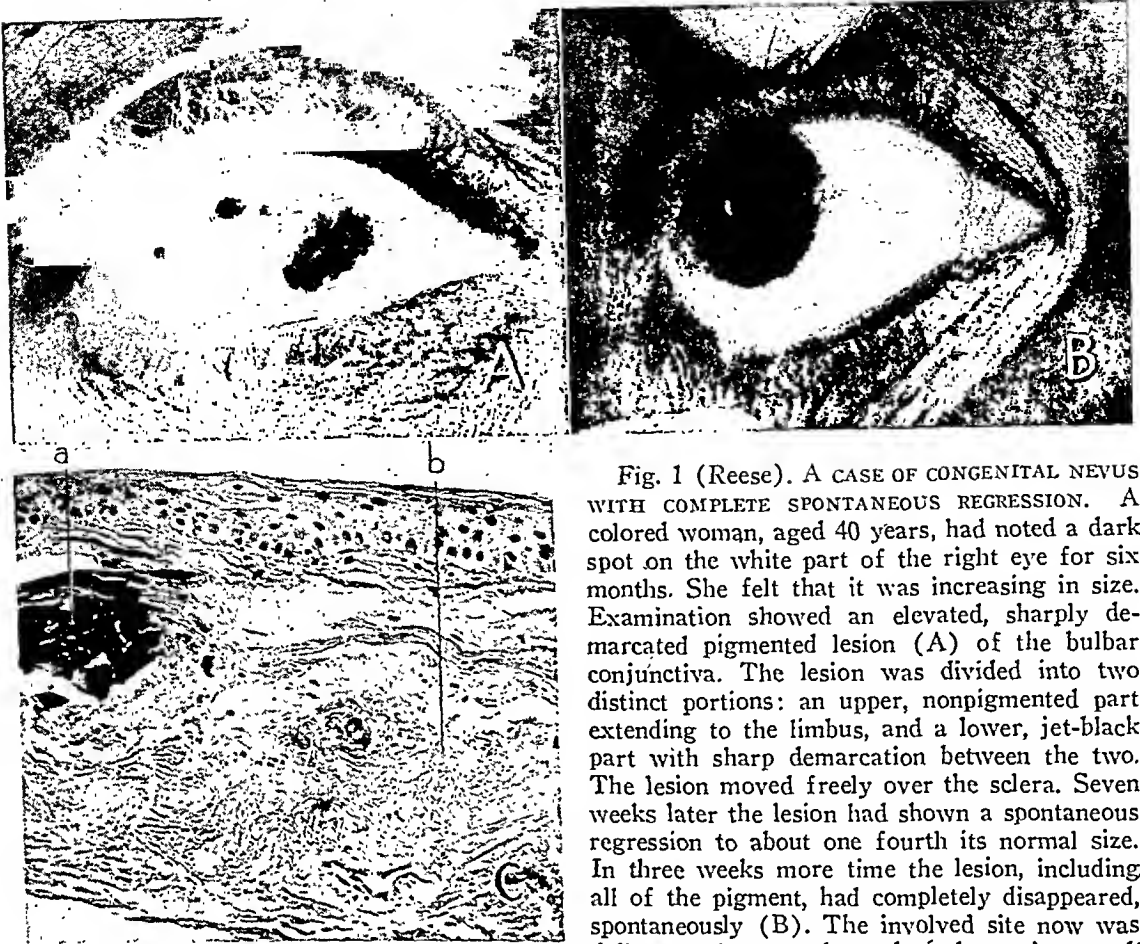


Fig. 1 (Reese). A CASE OF CONGENITAL NEVUS WITH COMPLETE SPONTANEOUS REGRESSION. A colored woman, aged 40 years, had noted a dark spot on the white part of the right eye for six months. She felt that it was increasing in size. Examination showed an elevated, sharply demarcated pigmented lesion (A) of the bulbar conjunctiva. The lesion was divided into two distinct portions: an upper, nonpigmented part extending to the limbus, and a lower, jet-black part with sharp demarcation between the two. The lesion moved freely over the sclera. Seven weeks later the lesion had shown a spontaneous regression to about one fourth its normal size. In three weeks more time the lesion, including all of the pigment, had completely disappeared, spontaneously (B). The involved site now was dull, granular, nonelevated, and nonpigmented.

After two months, no change was noted, and a piece of tissue from the former site of the lesion was removed for biopsy (C). Under the conjunctiva is a structureless, amorphous, degenerated tissue with no visible nuclei. At (a) and (b) there is coagulation necrosis with calcium deposition in (a). This tissue showed negative reaction to stains for hyalin. No trace of pigment or nevus cells. (Hematoxylin and eosin stain.) This was a congenital, nonpigmented nevus which suddenly became partially pigmented and later went on to complete and spontaneous regression.

toplastm of a melanoblast. This seems to convert a preëxisting premelanin or melanogenic substance in the protoplasm into black, visible melanin. It probably does not cause the melanin to be produced by metabolism of the cell protoplasm. The oxidation of this preëxisting leukomelanin into black melanin takes place rapidly and is reversible; that is, after the melanin has been formed, it can be reduced to the invisible premelanin. Clinically, we may see the pigment content of a nevus increase rapidly and this change is frequently mistaken for active growth. Also, the pigment content of

a nevus may decrease and, in fact, the entire nevus may disappear spontaneously and completely (fig. 1). Also, acquired spontaneous precancerous melanosis may appear, regress, and reappear (fig. 2). This fluctuation in the pigment content is contingent on the process of oxidation and reduction.

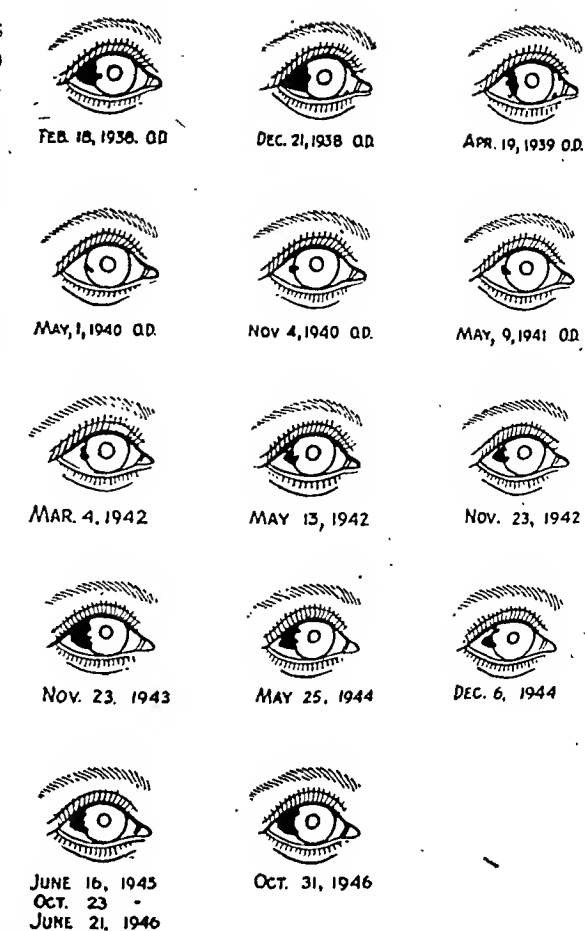
There is evidence of a hormonal influence in pigmentation in animals and man. The sex hormones in particular are implicated as shown by many workers including Willier⁴ using the color pattern in the plumage of birds and Gordon⁵ using fishes, as their media. Hamilton⁶

Fig. 2 (Reese). A CASE OF PRECANCEROUS MELANOSIS WITH SPONTANEOUS REGRESSION AND REAPPEARANCE. A woman, aged 45 years, noticed what she thought was a hemorrhage the size of a pinhead on the white part of the right eye in 1931. This gradually enlarged. She was observed first in February, 1938, at which time there was a nonelevated, pigmented lesion of the bulbar conjunctiva temporally adjacent to the limbus, measuring 5 by 5 mm. and encroaching for 1 mm. on the cornea. There was a diffuse, fine, granular pigmentation of the bulbar conjunctiva nasally. The patient was observed elsewhere from time to time until December, 1938, when it was noted that the lesion measured 7 by 7 mm. with no apparent increase in the granular pigmentation nasally. In April, 1939, it was observed that the lesion had regressed. The regression occurred spontaneously as there had been no treatment. The drawing above shows consecutive sketches drawn to scale. Some of these were used in a previous article.¹⁰ The fine, granular pigmentation of the bulbar conjunctiva nasally also disappeared. In May, 1941, no actual recurrence was seen, but there was noted with the slitlamp a fine, granular pigmentation at the site of the former lesion and for some distance around it. In May, 1942, in addition to the pigment shown in the sketch, there was also noted again a slight diffuse pigmentation of the bulbar conjunctiva nasally.

In addition to the ocular findings, there were pigmented lesions elsewhere which were undergoing changes. In April, 1939, a pigmented lesion on the right cheek of unknown duration disappeared spontaneously, leaving a slightly elevated, non-pigmented area, with an uneven surface, measuring 5 by 3 mm. In May, 1941, there was a slightly brownish papule in the right periauricular region, measuring 4 mm. in diameter, of three months duration. In October, 1941, this lesion had disappeared.

and others have studied the pigment deficiencies of eunuchs. Pack⁷ has never encountered a malignant melanoma in human beings before puberty but feels that they are particularly prone to occur, and to be unusually malignant at the time of puberty. The pigment in the skin, in congenital nevi, and in the iris also manifests itself more markedly at puberty. A melanoma is more malignant when it occurs during pregnancy at which time there is also other evidence of pigment activity, as exemplified in the usual increase in the pigmentation of the areola of the breasts and vulva.

There is not much evidence that genetics and heredity play a very important role in pigmented tumors. There are a few instances, however, in which a



definite familial tendency was observed in the incidence of malignant melanoma of the uvea. The most noteworthy is that cited by Davenport⁸ of five cases in three generations of one family. I have seen two sisters with a malignant melanoma of the ciliary body. Gordon⁹ has demonstrated the significance of genetics and heredity in the transmissibility of melanoma in fishes.

Free melanin is liberated from the protoplasm of melanoblasts of the skin and conjunctiva both as a constant physiologic occurrence and as a response to some provoking factors, such as actinic rays, neoplasms, and hyperpigmented states. The melanin particles are either absorbed and may be detected in the urine and the lymph nodes, or they may be phagocy-

tosed by the histiocytes of the derma or submucosa. The cells that take on, and merely harbor melanin made by other cells are called melanophores or chromatophores.

TYPES OF MELANOBLASTS

I have given this preliminary discussion of melanoblasts and melanin in general, and my efforts will now be directed toward presenting histologic and clinical evidence in favor of the existence of various types of melanoblasts from which stem various types of tumors. The subject is still highly speculative but there does seem to be sufficient evidence to warrant using the following outline for the purpose of this discussion.

NEUROGENIC MELANOBLAST

A. Schwann cell

Location: all peripheral nerves

B. Nevus cell

Location: peripheral sensory nerve terminals

C. Melanoblasts stemming from secondary optic vesicle

Outer layer—

1. Location: pigment epithelium of the retina and ciliary body (fig. 3-A, B)

2. Location: dilator and sphincter muscles of iris (fig. 3-C)

Inner layer—

Location: pigment epithelium of iris (retinal epithelium of iris) (fig. 3-D)

D. Lepto-meninges (pia)

Location: brain and optic nerve

ECTODERMAN MELANOBLAST

Location: basal layer of the skin and mucous membranes

MESODERMAL MELANOBLAST

Location: uvea, sacral and extra-sacral mongol spot

NEUROGENIC MELANOBLASTS

A. SCHWANN CELL

A fibrous syncytium of Schwann cells sheathes all peripheral nerves immediately upon their exit from the central nervous system. Normally the Schwann cell does not produce pigment, but in pathologic states this cell becomes very versatile and may not only produce melanin but also, according to Masson and Martin,¹⁰ a metaplastic striated muscle; according to Wilson,¹¹ bone; and accord-

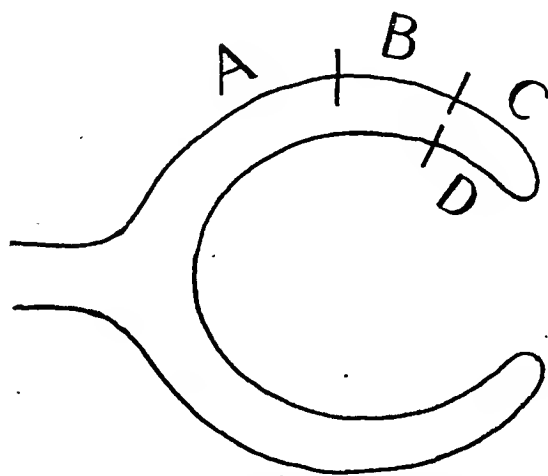
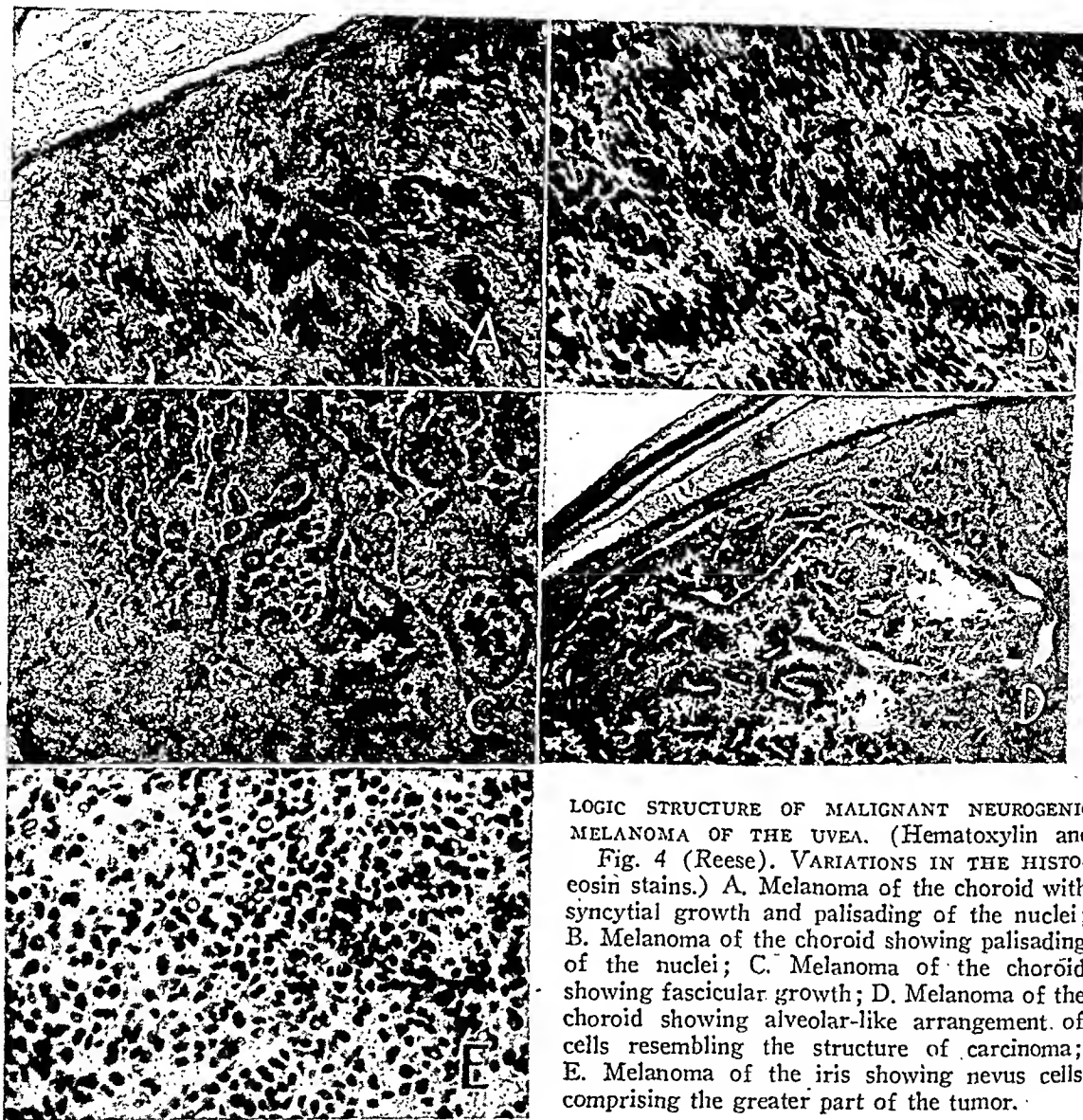


Fig. 3 (Reese). SECONDARY OPTIC VESICLE. A. Anlage of pigment epithelium of retina; B. Anlage of pigment epithelium of ciliary body; C. Anlage of dilator and sphincter muscles of iris; D. Anlage of pigment epithelium of iris (retinal epithelium of iris).

ing to Groth,¹² cartilage and fat. Moreover, it becomes modified at the sensory nerve terminals to form various manifestations of end-organs, including the Meissner corpuscle, the Pacinian body, and the tactile cell of Merkel and Ranvier.

A tumor arising from this cell along the trunk of a nerve usually contains no pigment, is encapsulated, and is benign. In ophthalmology it is more often seen in the orbit and is called a neurinoma or neurilemmoma. A tumor arising from this cell at the sensory nerve terminals or near these nerve terminals is usually associated with the production of pigment, is



LOGIC STRUCTURE OF MALIGNANT NEUROGENIC MELANOMA OF THE UVEA. (Hematoxylin and

Fig. 4 (Reese). VARIATIONS IN THE HISTO-
eosin stains.) A. Melanoma of the choroid with
syncytial growth and palisading of the nuclei;
B. Melanoma of the choroid showing palisading
of the nuclei; C. Melanoma of the choroid
showing fascicular growth; D. Melanoma of the
choroid showing alveolar-like arrangement of
cells resembling the structure of carcinoma;
E. Melanoma of the iris showing nevus cells
comprising the greater part of the tumor.

frequently called a nevus or a melanoma, and may be quite malignant. A tumor arising from both the nerve trunk and the sensory terminals, and being, therefore, a diffuse lesion, is usually called neurofibromatosis and this type of lesion is also associated with the production of pigment. According to Stout,¹³ 20 per cent of neurofibromas become malignant.

A benign or a malignant melanoma of the uvea may also arise from the Schwann cell. This idea was first advanced by Theobald¹⁴ who presented specimens showing nerves fanning out into the tumor tissue indicating that the neoplasm arose from the Schwann sheath.

She also pointed out the occurrence of benign pigmented lesions associated with the ciliary nerves.

Further evidence supporting the neuralistic postulate of some melanomas of the uvea is the following:

1. The histologic structure of some of the uveal melanomas is consistent with that of the neurinoma which appears elsewhere. This is particularly true in regard to the syncytial fascicular type of growth and the palisading of the nuclei (fig. 4-A, B, C).

2. The short, as well as the long, ciliary nerves on the side of the globe harboring the melanoma may show enlargement due

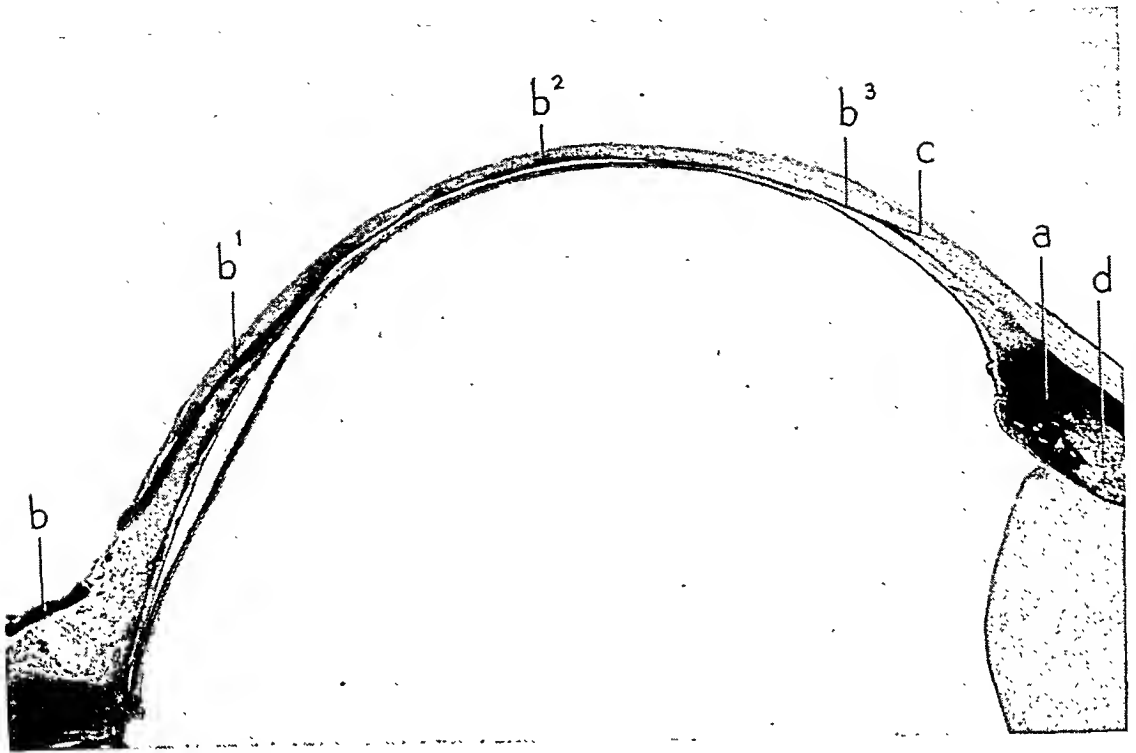


Fig. 5 (Reese). A MALIGNANT NEUROGENIC MELANOMA of the iris (a) with enlargement of the long ciliary nerve seen at (b), (b¹), (b²), and (b³). At (c) an intrascleral nerve loop extends off of the main branch. At (d) there are cystic spaces in the tumor. The nerve at (b) and (b¹) is 3 to 4 times the size of the same nerve to the opposite side of the optic nerve. (Hematoxylin and eosin stains.)

to overgrowth of the Schwannian element (fig. 5). A similar enlargement of the ciliary nerves, but to a greater extent, may be seen in cases of neurofibromatosis involving the trigeminal area but not the orbit directly. In such instances benign pigmented lesions may be present in the uvea.

3. A ciliary nerve coursing toward the site of a melanoma of the uvea may show single or multiple benign melanomatous growths composed of Schwann cells (fig. 6-A, B).

4. Typical nevus cells may be seen at sites in a uveal melanoma and in some instances, particularly when the lesion is located in the iris or ciliary body, the entire tumor may be composed of nevus cells (fig. 4-E).

5. There are reports in which the eye affected with a malignant melanoma

showed an anesthesia of the cornea (Sédan, 1934¹⁵) and an alteration in the size and reaction of the pupil (Philippsen, 1891¹⁶).

6. In amphibia and fowls when a portion of the neural crest is transplanted, the site of the transplantation on the host takes on pigment characteristics of the donor. It has been shown by Willier¹⁷ in fowls that melanoblasts migrate out from the neural crest into the mesoderm and that these cells determine the pigment pattern of the animal. Grafts transplanted before these neurectodermal melanoblasts have migrated into the mesoderm show no pigment changes in the host and those transplanted after the migration show the pigment pattern of the donor animal. This would indicate that neurectodermal melanoblasts can appear far and wide from their anlage, and sug-

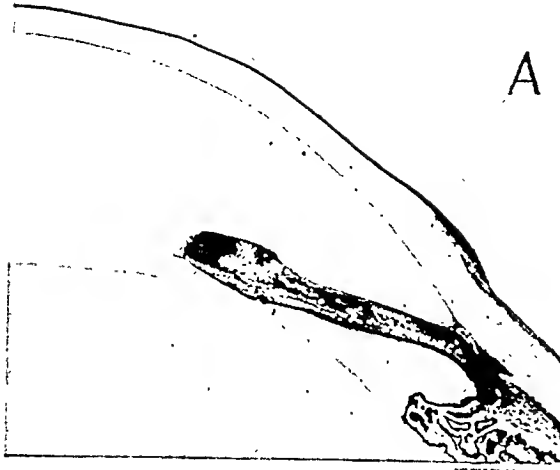
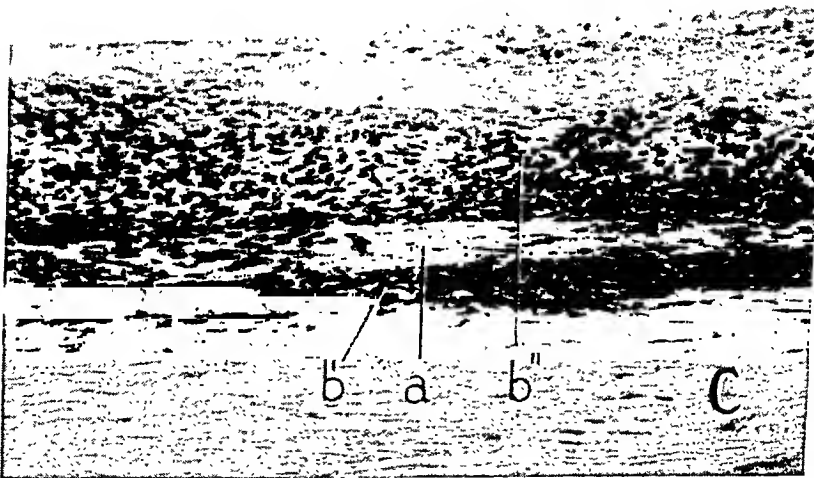
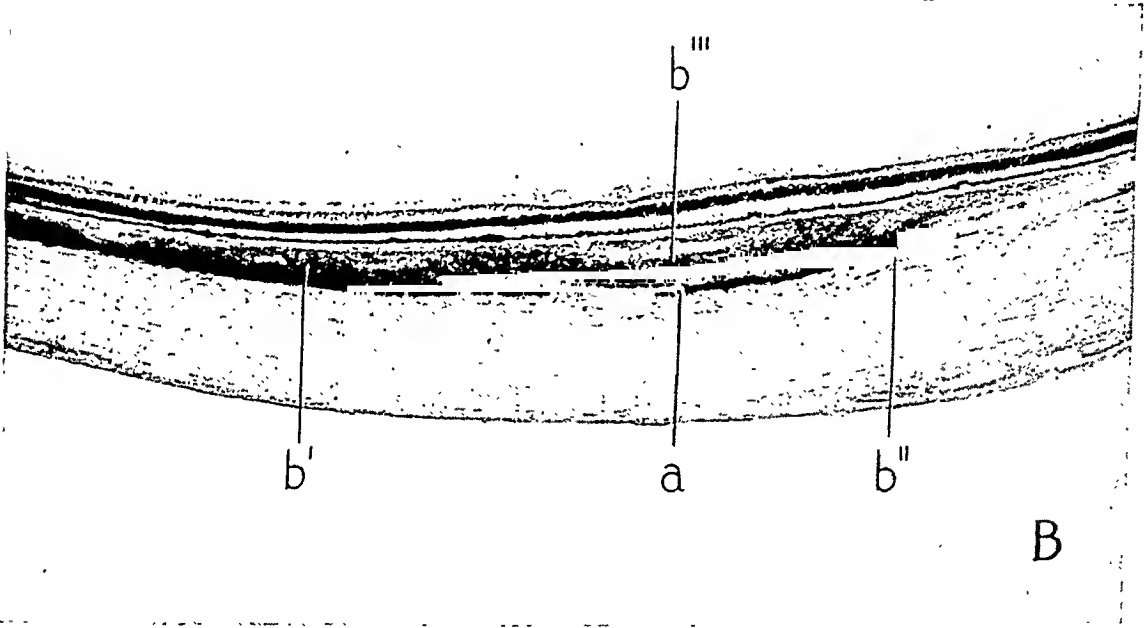


Fig. 6 (Reese). A MALIGNANT NEUROGENIC MELANOMA of the iris with a benign neurogenic melanoma of the long ciliary nerve. A. A diffuse malignant neurogenic melanoma of the iris; B. The long ciliary nerve (a) coursing toward the tumor shows a large fusiform pigmented enlargement (b'), (b''), (b'''), due to overgrowth of the Schwannian cells (benign neurogenic melanoma); C. A high power of (B) at (a) showing long ciliary nerve (a) with its fusiform pigmented overgrowth of Schwannian cells (b')-(b'').



gests the possibility that melanoblasts most anywhere could stem from the neurectoderm.

7. Cases reported in ophthalmic literature supporting the neurogenic thesis are the following:

- a. Strachov¹⁸ reported a case showing general manifestations of Recklinghausen's disease, neurinoma of the right orbit, and a malignant melanoma of the choroid of the left eye.
- b. Gartner¹⁹ reported a case of malignant melanoma of the choroid with multiple skin nodules which proved to be manifestations of Recklinghausen's disease. He also cited three other cases in the literature in which the two conditions were associated.
- c. Moorhouse²⁰ reported a tumor of the choroid which resembled a malignant melanoma but was diagnosed microscopically a neurofibroma. He claimed that a subsequent general examination established a diagnosis of Recklinghausen's disease.

Theobald's¹⁴ contention that melanomas of the uvea may be neurogenic is well documented and there seems no reason to doubt that such tumors may arise from Schwann cells. Judging by the behavior of tumors elsewhere which arise from Schwann cells or allied cells, one must presume that the nearer the tumor is to the nerve-trunk type of lesion (neurinoma) the more benign it is, and the nearer it is to the peripheral-nerve type of lesion (melanoma) the more malignant it is.

I²¹ called attention to the frequency of benign melanomas of the iris in eyes harboring a malignant uveal melanoma. It seems probable that these multiple manifestations occurred in neurogenic melanomas because diffuseness and multiple sites are common occurrences in neoplastic lesions of the Schwann cell.

B. NEVUS CELL

To discuss the nature of the nevus is to discuss Masson's contributions²² on the subject, so completely has his work dominated the picture. However, interpretation of his teachings varies among his disciples. It is conceded generally that the nevus is neurogenic and that it takes origin from the sensory nerve terminals, but, beyond this, speculation is rife regarding the more exact nature of the nevus cell. The Merkel-Ranvier tactile cell is most frequently implicated.

Most of the work on the Merkel-Ranvier cell has been done on lower mammals, and surprisingly little information exists regarding these cells in the human being. Perez,²³ Ebert,²⁴ and others by special silver stains describe in the human skin a complex terminal arborization of nerve fibers at the dermo-epidermal junction. Expansions of these nerve terminals were noted around the lower pole of cells scattered at irregular intervals in the basal layer or the layer adjacent to it and these cells were larger and clearer than the neighboring cells. This cell type, together with its terminal nerve meniscus, constitutes the tactile cell of Merkel and Ranvier.

Masson²² describes his "cellule claire" (fig. 7) as occurring at irregular intervals along the junction of the epidermis and the cutis. These cells differ from adjacent cells in their larger, irregular, kidney-shaped nucleus which is denser in chromatin. The long axis of the nucleus is often parallel to the junction of the epidermis and the cutis. Cytoplasmic projections extend into the neighboring intercellular spaces and sometimes into the corium (fig. 7-A, B). A well-defined clear space is noted around the cell. He felt that this clear cell is derived from the Schwann cell which migrated into the epidermis in fetal life.

Masson²² feels that the tactile cell of

Merkel-Ranvier is indistinguishable histologically from the clear cell, that they are both functional and morphologic modifications of the same cell strain—the Schwann cell—and that the nevus cell stems from these cells.

Nevus cells, besides growing diffusely in the epidermis and corium, frequently grow in small clusters and nests beneath the epithelium, or are arranged as abor-

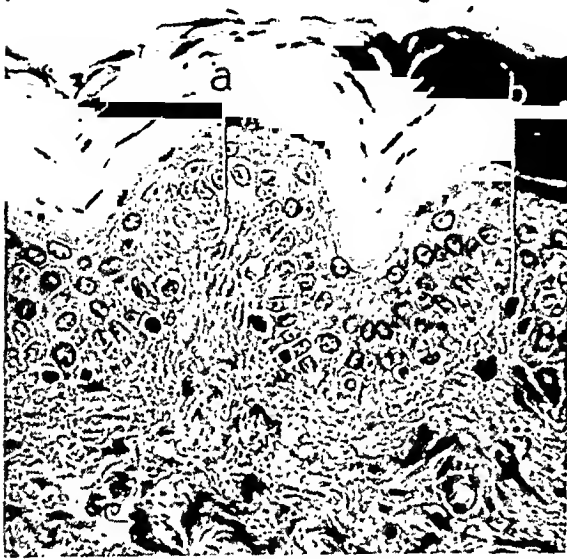


Fig. 7 (Reese). A SECTION OF THE SKIN from the palmar surface of the forearm. The clear cells of Masson are seen scattered along the basal layer. At (a) and (b) a clear cell shows its clear cytoplasmic extension between adjacent basal cells. (Trichrome stain.) (This microphotograph was loaned through the kindness of Dr. Pierre Masson.)

tive forms of specialized tactile organs such as Meissner corpuscles and Pacinian bodies. Foot²⁵ believes that the frequent nests of nevus cells can be viewed as caricatures of Meissner corpuscles. In some nevi, and particularly those of the scalp and in neurofibromatosis of the uvea, well-formed and identifiable Meissner corpuscles are seen.

Masson²² has demonstrated that the structure of a nevus is in general as follows—trunks of sensory nerves approach the deeper layers of the derma beneath the site of a nevus; as those

nerves become more superficial they lose their myelin and their Schwann sheath becomes continuous with a syncytium of nevus cells, which bud out along the nerve branches like flowers from a much branched stem; nerve axones can be traced down the center of these branches or “neuroid tubes” and arborize around the nevus cells in the same manner that they do around the tactile cells of Merkel and Ranvier.

The nevus cell is basically a Schwann cell and, therefore, may sheath the terminal branches of the sensory nerves which act as a scaffolding, or appear at the nerve terminal as a modified tactile cell (Merkel-Ranvier, clear cell). Both types may be present in the same tumor, or one or the other may predominate. Thus, we can recognize a superficial and a deep nevus, or a combination of both.

A superficial nevus lies in and just under the epithelium and comes more from the clear cell or Merkel-Ranvier cell. The cells arrange themselves in nests, which, in the deeper portion, are more elongated and columnar around nerve fascicles and, in the superficial portion, are more spheroidal and more closely resemble caricatures of Meissner corpuscles. Pigment formation is more conspicuous.

A deep nevus lies in the derma under the epithelium, arises more from the nerve sheaths and frequently shows an intervening stratum of normal connective tissue between it and the epithelium. The nerve scaffolding with its outgrowths of nevus cells is more pronounced and the tendency to distorted tactile corpuscles is less. The nevus nests have an affinity for the deep hair follicles. A neurofibromatous element is not infrequent and Laidlaw²⁶ has described what he calls the “cable effect” due to fusiform thickening of associated nerves from proliferation of Schwann cells. Pigment formation is less conspicuous.

There may be a combination of the superficial and the deep nevus, with the superficial part in relation to the epithelium and separated from the deep portion by an intervening layer of connective tissue. Foot²⁵ postulates that one might speak of a neurofibroma developing up to the point where the myelin sheath ends in the nerve trunk, and of a neuronevus when the tumor is situated beyond that point, including the end organs of the nerve.

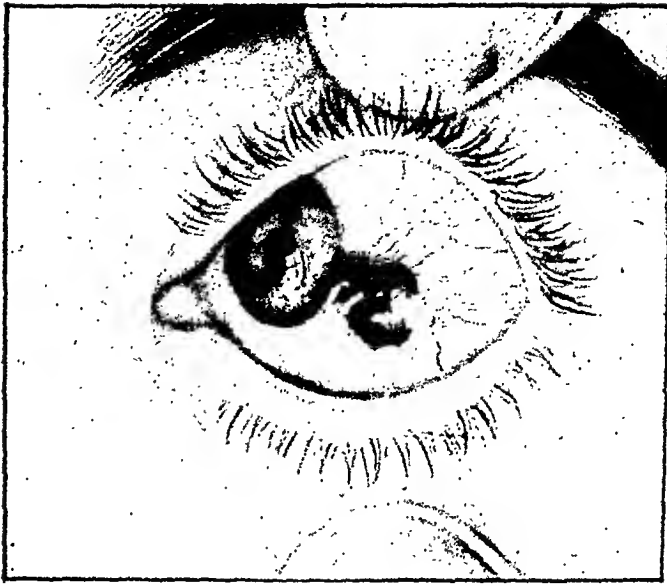
The nevus cell, therefore, is to be viewed as a modified Schwann cell at the site where Schwann cells normally differentiate into various types of sensory end organs. It is a cell which in its metamorphosis lies between the Schwann cell and the fully differentiated end-organ cell. It is thus not surprising to find sometimes in nevi all morphologic stages ranging from the Schwann cell to the fully developed sensory end-organ. The nevus cell in the role of a melanoblast is consistent to the extent that pigment formation is known to be closely associated with the peripheral sensory terminals. Further than this, however, we cannot go except to surmise that perhaps these terminals elaborate an oxidase.

Laidlaw and Murray²⁶ have advanced a very interesting theory regarding the relationship of nevi to the evolution of the hair follicle. In reptiles and amphibia, which are just below the mammals in the phylogenetic scale, we find normally scattered over the body pigmented dots having the microscopic structures of human nevi. For instance, in the alligator there are numerous black dots prominently seen over the smooth white skin of the upper and lower jaws. Each dot is a tactile organ in which a sensory nerve terminates. As the mammal evolved from the reptilian form, the tactile spots disappeared and were replaced by hair follicles which are primarily tactile organs with

color and warmth as secondary functions. In the human being, the association of nevus and hair follicle is not uncommon, and the nerve terminals around the cells composing each are the same. The hairy, pigmented nevus may be viewed as a link or transition between the aforementioned tactile organs of the reptilian type and the hairy tactile organs of the mammalian type. Ribbert²⁷ felt that many lesions in the human being, including pigmented nevi, represented instances of imperfect survival of structures normal in animals lower in the phylogenetic scale.

In ophthalmology, we see nevi of the skin, of the lids and, more commonly, of the conjunctiva and particularly in the region of the limbus and caruncle. Nevi, or at least their matrices, are congenital, but at birth they are usually not seen because they are small and more or less flesh colored. They seem to grow in size somewhat during the first decade of life, and pigmentation takes place between the ages of 4 to 14 years, particularly around puberty. Some of the larger nevi may show pigmentation even in infancy. It is during the period in which pigmentation is acquired that they are usually noticed for the first time. They seem to undergo some regression in later years and rarely disappear spontaneously and completely (fig. 1). Each individual averages about a dozen or more skin nevi with a predilection for the head, neck, and genital regions.

Approximately one third of the conjunctival nevi do not show pigmentation, but are of a pinkish salmon color. There may be a rather rapid change in the pigment content even in adult life so that a formerly nonpigmented tumor becomes pigmented (fig. 1), or a partially pigmented tumor becomes increasingly pigmented. When the pigment occurs in a formerly nonpigmented growth, the patient may give the history of having noted the lesion for the first time (fig.



A

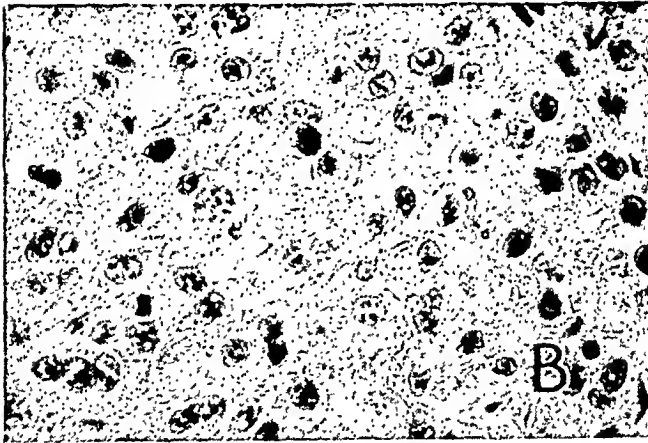


Fig. 8 (Reese). A MALIGNANT NEUROGENIC MELANOMA OF THE CONJUNCTIVA WHICH AROSE FROM A CONGENITAL NEVUS

A man, aged 29 years, had a pigment spot on the bulbar conjunctiva of the left eye temporarily ever since he can remember. When inducted into the army five years ago, the lesion was diagnosed as congenital nevus. During the past two years the spot has grown progressively larger and more elevated. Three months ago it was excised.

A. The lesion before excision. The tumor is quite elevated and sharply demarcated with an upper, flatter, and more densely pigmented portion and a lower, more elevated, but less densely pigmented portion. Many large blood vessels course to the lesion.

B. A section from the excised tumor. The cell border of the protoplasm is well demarcated; there is variation in the size of the nuclei with a tendency to multinucleated cells. (Hematoxylin and eosin stains.)

The tumor recurred three months after the excision, and an exenteration of the orbit has been done.

1). When there has been an increase in the pigment content, both the patient and the doctor may mistake this for growth of the tumor. The appearance and disappearance of melanin in these tumors is based

on oxidation and reduction as previously discussed.

There is no doubt that a nevus can develop into a malignant tumor, but such an occurrence is an extreme rarity. When

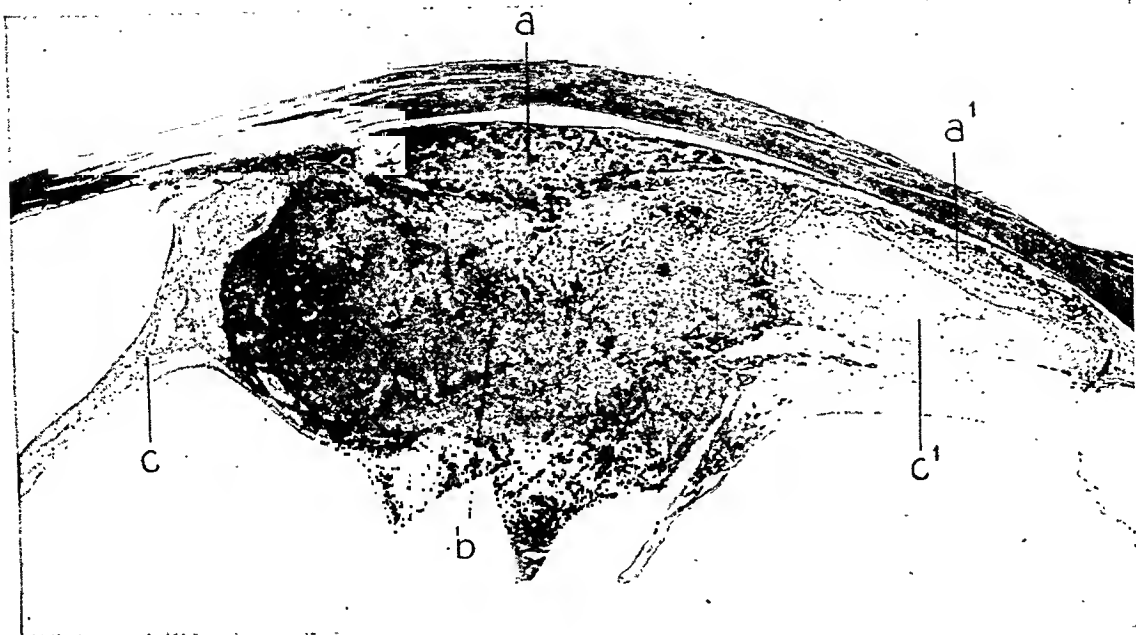


Fig. 9 (Reese). HYPERPLASIA OF THE PIGMENT EPITHELIUM of the retina into a large tumorlike mass resulting from an old inflammatory process of childhood.

A woman, aged 56 years, had attacks of "sore eyes" about the age of 5 to 6 years. After this the vision was always poor. For five years both eyes were painful and the vision became further reduced with ultimate blindness and severe pain in the left eye requiring enucleation.

Clinical examination of the left eye showed dilatation of the episcleral vessels and a tension of 70 mm. Hg (McLean). There was a corneal pannus which prevented a view of the interior. The right eye was slightly congested; the cornea showed opacities; there were posterior synechiae; and the tension was 38 mm. Hg (McLean).

The above microphotograph is from the left eye and shows marked hyperplasia of the pigment epithelium. At (a) and (a') the hyperplasia still resembles the mother cells but at (b) it takes the form of a tremendous plaque of metaplastic fibrous tissue interspersed with pigment. The complete gliosed and adherent retina is seen at (c) and (c'); and elsewhere in the eye there was some bone formation in old scar tissue.

The cornea showed old, degenerating scar tissue with calcium deposits; there were peripheral anterior synechiae, occlusion of the pupil, and complete glaucomatous cupping of the disc. (Hematoxylin and eosin stains.)

The consensus of those who studied this section, including Dr. F. H. Verhoeff, was that this represented a pure hyperplasia of the pigment epithelium into a tumorlike mass. (It is through the courtesy of the American Registry of Ophthalmic Pathology and Dr. J. C. Johnston of Charlotte, North Carolina, that this specimen is available.)

such a malignant melanoma does arise, it is a localized elevated tumor mass (fig. 8-A).

True nevus cells may constitute a part or the whole of a neurogenic melanoma of the uvea and particularly is this true when the site of the tumor is in the iris or ciliary body (fig. 4-E). The reason no doubt is that sensory-nerve terminals are more frequent in the anterior uvea. The occurrence of true nevus cells in the uvea has never been pointed out. This finding

furnishes a necessary link in establishing the relationship of some uveal melanomas to the neuronevus seen elsewhere.

C. MELANOBLASTS STEMMING FROM THE SECONDARY OPTIC VESICLE

The entire outer layer of the secondary optic vesicle gives rise to melanoblasts. The posterior portion is the anlage of the pigment epithelium of the retina (fig. 3-A); the middle portion, the pigment epithelium of the ciliary body (fig. 3-B);

and the anterior portion, the dilator and sphincter muscles of the iris (fig. 3-C). Only the anterior portion of the inner layer of the vesicle gives rise to melanoblasts—the pigment epithelium of the iris (fig. 3-D).

Outer Layer

1. PIGMENT EPITHELIUM OF THE RETINA AND CILIARY BODY

a. *Tumors arising from the pigment epithelium of the retina.* These cells proliferate on the slightest provocation. When sufficiently provoked by pathologic processes, their hyperplasia may manifest itself in large plaques of tissue having the characteristics either of the mother epithelial cell or of the metaplastic fibrous tissue (fig. 9). It is safe to say that practically all acquired pigmentary changes in the fundus, not of a neoplastic nature, occur as the result of proliferation of this tissue. It is strange, therefore, that neoplasms arising from these cells are among the rarest occurrences in ophthalmology. Pure hyperplasia into tumorlike masses provoked by some chronic pathologic process in the eye is the usual lesion seen (fig. 9), but as an extreme rarity a true neoplasm may arise from this hyperplasia. These hyperplastic and real tumors are usually found coincidentally in eyes removed for other causes. That the neoplasms arising from this tissue may be malignant and metastasize is illustrated by the case reported by Griffith.²⁸ This is a 37-year-old man whose left eye had been blind for several years. Recently this eye became painful and was, therefore, enucleated. In the routine examination of the eye, a tumor arising from the pigment epithelium was found. Seven months later a recurrence in the orbit was noted, and three months later the patient died from metastasis to the liver.

b. *Tumors arising from the pigment epithelium of the ciliary body.* In these

cases (fig. 10) the overlying nonpigmented epithelium, as well as the pigmented epithelium, may participate. These tumors arise under the same circumstances as those of the pigment epithelium of the retina. They are seen in adult eyes which have been blind for many years, often since childhood. In these eyes there is always residuum of an old inflammatory process, such as a cyclitic membrane with bone formation resulting from an old endophthalmitis. The tumor begins after the inflammatory process has run its course, as evidenced by the fact that the tumor cells invade the already formed organized fibrous tissue or bone. Histologic evidence indicates that the tumor unquestionably arises from a pathologic proliferation of the epithelium.

2. DILATOR AND SPHINCTER MUSCLES OF THE IRIS

Tumors arising from this layer are spontaneous neoplasms. They have the clinical characteristics of involving primarily the pupillary area, showing a flat, diffuse type of growth, and frequently producing an ectropion of the pigment epithelium. These tumors are referred to as leiomyomas.

Inner Layer

PIGMENT EPITHELIUM OF THE IRIS (RETINAL EPITHELIUM OF IRIS)

The tumors from this layer also arise from a hyperplasia provoked by an old inflammation. Spontaneous tumors may also arise from the layer. These occur in younger persons and the tumor tissue resembles more or less the embryonic type of retina. They are usually referred to as dictyomas.

D. MELANOBLASTS OF THE LEPTOMENINGES

The pia covering the optic nerve normally contains long, branching melano-

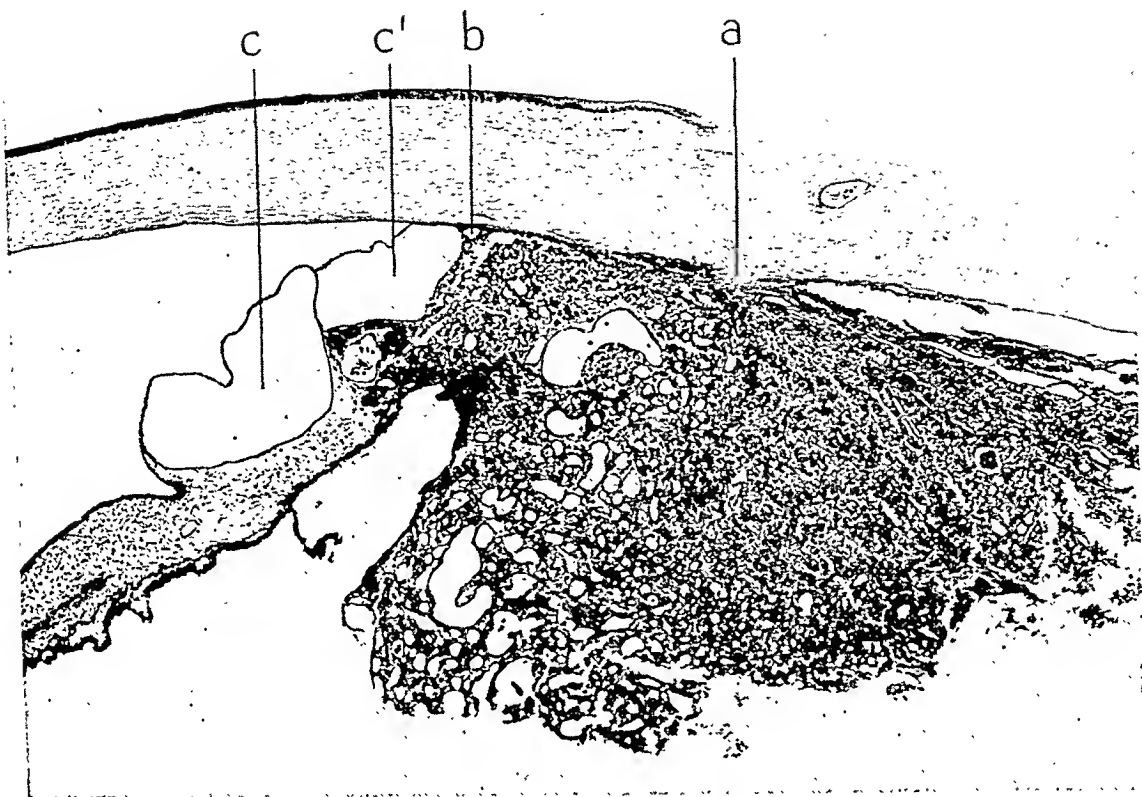


Fig. 10 (Reese). A MELANOADENOCARCINOMA of the ciliary body arising from the pigment epithelium subsequent to an old inflammatory hyperplasia.

A woman, aged 46 years, suffered a penetrating injury to the right eye at the age of 16 years. Following this the vision was decreased and has become gradually worse so that for the past five years the eye has been blind. During the past year the eye has been red off and on and sufficiently painful to warrant enucleation.

Clinical examination showed congestion of the bulbar conjunctival vessels, especially nasally. In the periphery of the iris at the upper nasal quadrant from the 1- to the 4-o'clock positions, there is a cyst, the base of which seems to arise from the ciliary body. The anterior wall is adherent to the cornea in the angle, and the posterior wall rests upon the lens. There is some dense pigmentation of the adjacent iris tissue and dense pigmentation along the anterior capsule of the lens below the cyst. The lens is completely cataractous preventing a view of the interior. Tension is 45 mm. Hg (Schiotz). The left eye was normal.

The above microphotograph is from the enucleated right eye and shows a melanoadenocarcinoma arising from a hyperplasia of the pigment epithelium of the corona ciliaris. The tumor has invaded and largely replaced the ciliary muscle and processes. The tumor extends into the anterior chamber, from the scleral spur (a) to (b), pushing the root of the iris ahead of it, filling the filtration angle and forming two large thin-walled cysts, (c) and (c'). The tumor forms acini and multilocular cysts. In the delicate stroma are small areas of calcification. The nonpigmented epithelium participates to some extent in the tumor. (Hematoxylin and eosin stains.)

This represents a malignant tumor arising from a hyperplasia of the pigment epithelium of the ciliary body subsequent to an old inflammatory process. (It is through the courtesy of the American Registry of Ophthalmic Pathology and Dr. Julian N. Dow of Los Angeles, California, that this specimen is available.)

blasts. The frequency and distribution of these pigmented cells of the lepto-meninges have been studied by Baader.²⁹ Primary malignant melanomas of the lepto-

meninges arise from these cells. Bailey and Bucy³⁰ speak of all tumors arising in the meninges as meningioma with some qualifying prefix. Consequently they use

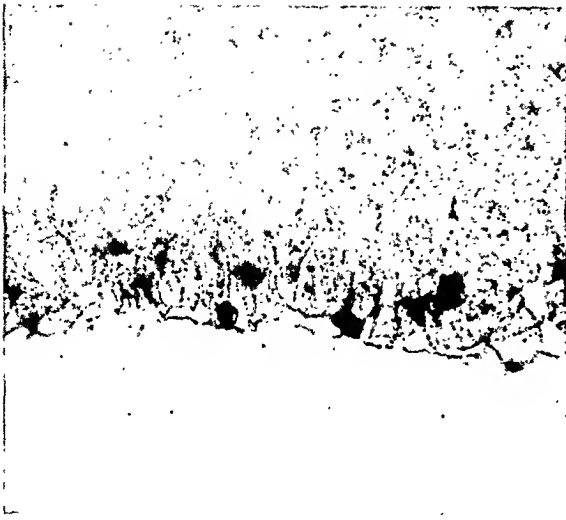


Fig. 11 (Reese). A frozen perpendicular section of the mucous membrane of the anal region showing the dendritic cells of the basal layer. (Ammonium silver stain.) (The microphotograph was loaned through the kindness of Dr. Pierre Masson.)

the term "melanoblastic meningioma" for what others call a malignant melanoma.

ECTODERMAL MELANOBLASTS

The basal layer of skin and mucous membranes is a site of melanin production. There is not entire agreement as to the nature of the cell or cells in which the melanin is formed. The various cells implicated in this question are the dendritic cell, the Langerhans cell, the clear cell of Masson, the Merkel-Ranvier cell, and the basal cell of the epithelium.

The dendritic cell (fig. 11) is a branching pigmented cell with its nucleus lying in relation to, and at a slightly lower level than, the basal cells and with its cytoplasmic processes ramifying between the overlying epithelial cells and into the underlying corium. When the cell contains no pigment, it is a rather large clear cell with the protoplasmic ramifications indistinctly seen, and this is the cell Masson calls "cellule claire" (fig. 7). Therefore, according to Masson, the dendritic cell and the "cellule claire" are the same cell with different names, depending on the presence or absence of pigment. When

pigmented, the cell may be seen in the natural state particularly when there is less or no pigmentation of the surrounding cells. The cell may be brought out by silver staining, as well as by the dopa reaction which is strongly positive. These cells are increased in number after irradiation and in hyperpigmented states.

Masson³¹ and others regard these dendritic cells as the sole producers of pigment. They believe that through their cytoplasmic processes these dendritic melanoblasts distribute pigment to cells in contact with them (fig. 12) and that all other cells, being the recipients and harbors of pigment, are melanophores. The protoplasmic processes of the dendrites are said to form not only a syncytium but also to extend to the corium and make contact with reticulo-endothelial system and, therefore, indirectly with the vascular endothelium and circulating blood. They, therefore, constitute a communicating cellular net effecting a metabolic exchange between the circulation and the epidermis. From the corium, the dendrites derive substances of the pigment matrix, form melanin, and deliver it through their processes to the epidermal and dermal cells.

The Masson³¹ concept interprets the dendritic melanoblasts as elaborating or excreting melanin in the same way that glandular cells excrete their products and, therefore, should be really considered glandular cells. The protoplasmic processes inoculate or inject the pigment into the cells of the epidermis and derma with which they come in contact (fig. 12).

The dendritic melanoblasts may wear out and cease to function as melanogenic cells. Such cells are probably replaced by a proliferation of the persisting melanoblasts. Masson³¹ surmised that Langerhans' cells are worn-out or eliminated dendritic cells.

In support of their concept, the proponents cite the fact that in vitiligo some

dendritic melanoblasts still remain but lose their dopa-reaction and, therefore, their melanogenic function. In such instances the epidermis and the derma remain colorless. Also, regions sparsely pigmented such as the palms and soles show pigmentation only of the basal cells in contact with protoplasmic processes of the dendritic cells while the basal cells elsewhere are unpigmented.

Opposing this theory of Masson's,^{22, 31} Bloch³² has advanced several arguments:

1. There is a scarcity of histologic evidence.
2. Experimental work has failed to produce evidence that the basal cells have phagocytic properties.
3. The fact that the basal cells contain a pigment-forming ferment giving a positive-dopa reaction is not taken into account.
4. No explanation is given of how pigment is formed in skin containing no, or only a few, dendritic cells.
5. If melanoblastic properties belong only to the dendritic cells, it is difficult to understand why so long a time elapsed before these cells were found in normal human epidermis.
6. No explanation is given as to how marked pigmentation can exist in normal epidermis, as in the areola of the nipple, with no dendritic cells demonstrable; or, how pigmentation can occur in pathologic melanotic structures with no dendritic cells discernible even with the special stains.

Another hypothesis, which to me seems tenable, is that the dendritic cell represents only a morphologic variation from the basal cell. The number of the dendritic cells varies a great deal within a wide range, and all transitional forms, from the typical dendritic cell to the typical basal cell, seem discernible.

There are many observers who believe that the dendritic cell is merely a well-defined functioning state of a normal pig-

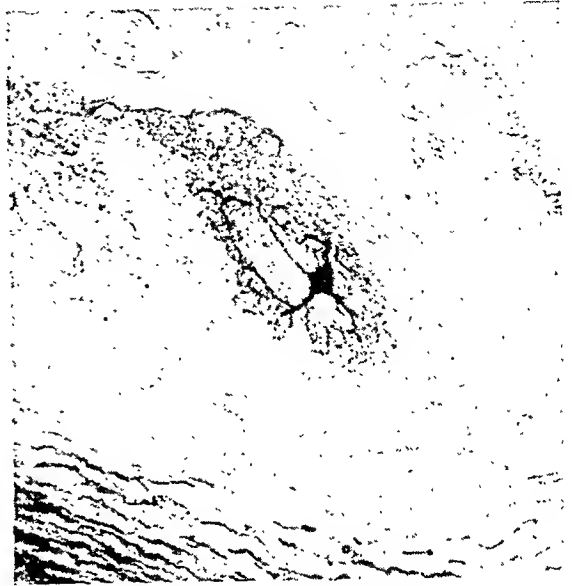


Fig. 12 (Reese). A section from the skin of the large toe showing a single dendritic cell distributing its melanin to the basal cells in contact with the dendrites. Elsewhere the epidermis is free of melanoblasts and pigment. (Cajal stain.) (This microphotograph was loaned through the kindness of Dr. Pierre Masson.)

ment-producing basal cell; that is, a melanoblast par excellence. According to Darier,³³ Bloch,³⁴ Miescher,³⁵ Kreibich,³⁶ and others, the basal cell changes its form and becomes the dendritic cell when its pigment-forming function is at its highest, and, according to Kreibich,³⁶ it changes back to its usual state of rest when increased activity subsides.

It is well known that the pigment epithelium of the retina has phototaxic properties exemplified by the protoplasmic extensions which occur between the rods and cones under exposure to light. This has been demonstrated in animals and is supposed to be true in man. I feel, therefore, that this phototaxic property may be an attribute of the basal layer of the epithelium and that the dendritic processes merely represent morphologic alterations in these cells resulting from their phototaxic property. The following is in support of this thesis:

1. It is known that the dendritic cells

increase in number after exposure to irradiation, and Meirowsky³⁷ found that the areas in which these cells have been increased in number by exposure to irradiation later showed a replacement of the dendritic cells by the normal-appearing basal cells. Peck³⁸ showed that in human skin after exposure to Thorium-X approximately 40 percent of all the basal cells were dendritic. He concluded, therefore, that dendritic cells are most likely a functional modification of ordinary basal cells.

2. Pigment in the basal cells is frequently located as a pigment cap at the superficial pole of the cell, that is, the pole toward the light.

3. After exposure to sun, pigment migrates through the epithelium even to the point of more or less depleting the basal layer. Even the skin of cadavers darkens on exposure to ultraviolet light due to the migrating of melanin to more superficial layers (Blum^{39, 40}).

According to Meirowsky,³⁷ the dendritically constructed melanoblast is present even in a state of rest, and its true form manifests itself by the influx of pigment into the preformed protoplasmic channels. The flow of pigment in prescribed protoplasmic channels has been demonstrated in amphibians, reptiles, and fishes, but not in higher animals (Schmidt,^{41, 42} Biedermann⁴³).

The so-called Langerhans' cell is only brought out by gold-chloride staining and is seen as a delicately branching structure in the epidermis, 3 to 5 cell layers from the corium. No nucleus has ever been demonstrated in this structure and, therefore, it is not a cell entity. Contrary to the belief, which has been erroneously propagated in the literature, the structures do not contain pigment and have nothing to do with pigment formation. Langerhans⁴⁴ considered them nervous end-organs. Masson,⁴⁵ Pautrier-Levy,⁴⁶ Caudière,⁴⁷ and Redslob⁴⁸ have added to the confu-

sion by merging into one the structure of Langerhans and the dendritic cell, and calling it "cellules de Langerhans." As previously mentioned, Masson³¹ viewed the structures described by Langerhans as worn-out dendritic cells which have ceased to function as melanogenic cells.

The nature of the Merkel-Ranvier cell has been discussed under "Nevus Cell" but it injects itself into this issue because of its position in relation to the basal layer of the epithelium and because by some it is considered identical to the dendritic cell and the clear cell.

I believe that the basal cells per se of all epithelium are melanoblasts or potential melanoblasts and that from these cells arise pigmented tumors having specific characteristics. The pigmented tumors in which the basal layer of the epithelium participate are:

1. *Precancerous melanosis*. At the average age of from 40 to 50 years, there may appear in the skin of the lids or the conjunctiva or both a nonelevated, diffuse mottled and more or less granular-appearing pigmentation which may remain with little or no change in a precancerous state for from 5 to 20 years before becoming malignant. The interval may be a great deal longer or considerably shorter, and sometimes the melanosis is malignant from the beginning. The pigment in the lesion may regress and recur (fig.2).

2. *Cancerous melanosis* (figs. 13 and 14). This is a malignant lesion which develops from precancerous melanosis. It may be so diffuse as to involve almost all the bulbar and palpebral conjunctiva and adjacent skin and still be entirely flat with no localized tumor mass. This is a very malignant tumor, and sometimes its harmless appearance with no elevation belies its serious character.

Both precancerous and cancerous melanosis histologically stem from the basal layer of the epithelium (fig. 14-B). These basal cells increase in number, be-

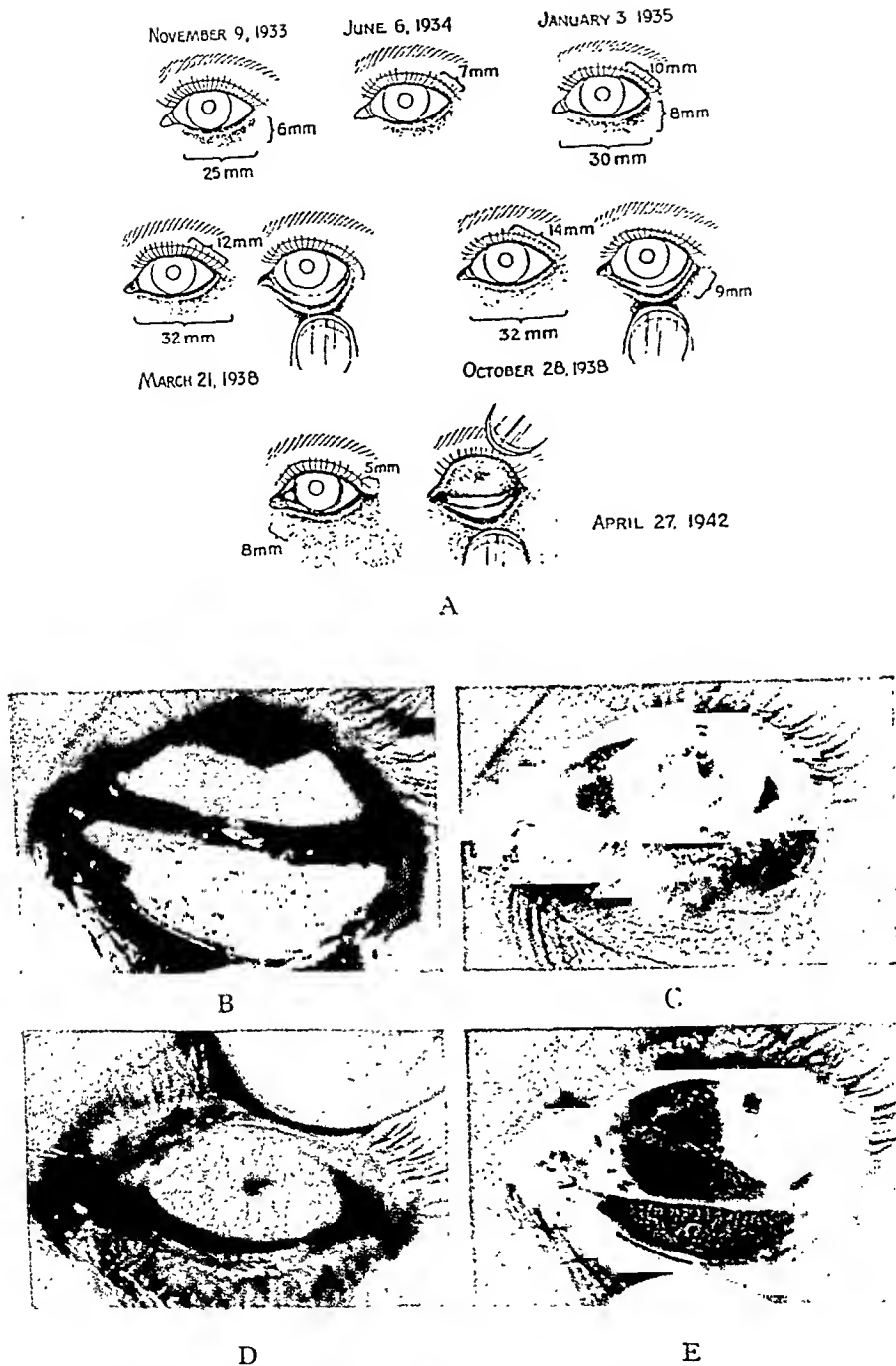
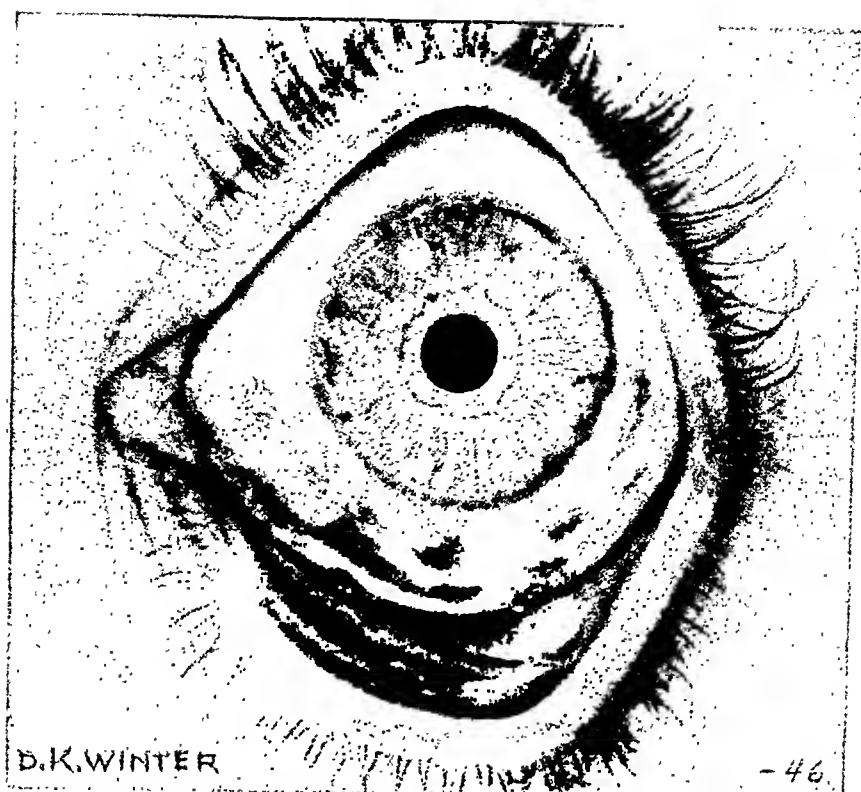


Fig. 13 (Reese). A CASE OF CANCEROUS MELANOSIS DEVELOPING FROM PRECANCEROUS MELANOSIS

A man, aged 50 years, first noticed a pigmented spot about the size of a pin point along the margin of the left lid in 1915. By 1927, it was about the size of a pinhead. There was further enlargement, so that, in 1932, a biopsy was performed; this showed precancerous changes. The lesion steadily progressed and the patient refused treatment. The sketches in A, drawn to scale, show the progression from November, 1933, to April, 1942. In May, 1942, Kodachrome slides were made as follows: B, pigmentation of the lower palpebral conjunctiva, fornix, and bulbar conjunctiva, shown with the lower lid pulled down; C, pigmentation of the upper and lower lids and the bulbar conjunctiva; D, pigmentation of the upper and lower lids and the upper palpebral conjunctiva, shown with the upper lid everted; E, pigmentation of the upper and lower lids, bulbar conjunctiva, caruncle, and semilunar fold, shown with the lower lid pulled down. At no site is there any elevation of the tumor, except perhaps in the lower fornix. The tumor is in the malignant phase, and exenteration should have been done at a much earlier period. (This case was used as an illustration in a previous article.⁴⁹)



A



Fig. 14 (Reese). A CASE OF CANCEROUS MELANOSIS DEVELOPING FROM PRECANCEROUS MELANOSIS

About 18 years ago, a woman, now aged 45 years, noted a small area of pigmentation on the conjunctiva of the left eye near the inner canthus. Ten years ago the lesion began to increase slowly in size and during the past seven years it has progressed with increasing rapidity.

A. The lesion just before exenteration. There is a diffuse, entirely nonelevated, granular pigmentation of the palpebral and bulbar conjunctiva, caruncle, semilunar fold, and lid margin.

B. A section of the conjunctival tumor. There is an increase in the basal cells which are large, hydropic, and extend into the submucosa and the overlying epithelium. (Hematoxylin and eosin stain.)

come pigmented, swollen, hydropic, and separated from one another by clear spaces. The proliferated basal cells extend into the overlying epithelium and sometimes replace it. They also extend into the underlying stroma.

3. The cells composing a basal-cell epithelioma may show a pigmentation which can be quite marked resulting in a uniformly dark-pigmented lesion sometimes clinically called a malignant melanoma.

4. A papilloma may also be darkly pig-

mented and thereby provoke the diagnosis of melanoma.

The nevus and the malignant melanoma which arises from it have different characteristics from the precancerous melanosis and the subsequent malignant melanosis.

The nevus is congenital, appears as a localized elevated lesion, rarely becomes malignant, but if it does, the resulting lesion is a localized, sometimes slightly pedunculated, single or multiple tumor mass (fig. 8). The tumor in both its benign and malignant phases is completely radio-resistant. Histologically, the malignant tumor is composed of large nucleolated cells with well-demarcated cell borders. The anaplasia may make the cells composing a melanoma arising from a nevus and one arising from a melanosis difficult to differentiate.

The precancerous melanosis is acquired about middle age or later, affects the conjunctiva and/or the adjacent skin in a very diffuse manner with no elevation, gives rise almost inevitably to the most frequent and malignant type of conjunctival and skin melanoma called malignant melanosis characterized by its diffuseness and lack of elevation (figs. 13 and 14-A). In the precancerous stage the melanosis is radio-sensitive, but in the malignant phase it is radio-resistant. Histologically, the tumor arises from the basal layer of the epithelium (fig. 14-B) and has distinguishing histologic characteristics in the benign and in the malignant phase.

Malignant melanosis of the conjunctiva and adjacent skin is by far more frequent than malignant melanoma arising from a nevus. I have seen only one case of a malignant melanoma of the conjunctiva or adjacent skin which could be said with certainty to have arisen from a congenital nevus (fig. 8-B). In five additional cases, however, the melanoma was suspected of having arisen from a nevus, not because of any known preëxisting nevus, but be-

cause of clinical and histologic evidence. I have seen 35 cases of malignant melanosis of the conjunctiva and/or skin of the lids arising spontaneously or from precancerous melanosis.

A review⁴⁹ of the voluminous literature on the subject up until 1942 revealed 42 cases that could be identified as definitely or presumably cases of malignant melanosis. Only two cases could be found which could be identified definitely as cases of melanoma which arose from a preëxisting nevus. One was reported by Lane⁵⁰ and the other by Rosenstein.⁵¹ In the latter case active growth followed a Koch-Weeks bacillus conjunctivitis. Many reports in the literature had to be discarded as unclassifiable because of incomplete data. On the basis of the cases seen by me and the identifiable cases in the literature, the malignant melanosis of the conjunctiva and skin of the lids is 10 to 15 times more frequent than malignant melanoma of nevus origin.

MESODERMAL MELANOBLASTS

These cells are usually long, narrow, and branching, but when their pigment content is increased, they take on a more polygonal or plump shape with few or no processes. Between these two extremes there are transitional stages depending somewhat on the pigment content. These cells are found primarily throughout the uveal tract (fig. 15-inset) and represent the bulk of this tract. They are generally referred to as chromatophores. This term implies that the cell is pigment-harboring rather than pigment-producing. The dopa reaction is negative in the adult but positive for a short period in the embryo. This fact, together with the cell's histologic characteristics in the normal as well as the pathologic state, places it definitely as a true melanoblast. Hereafter this cell will be referred to as the chromatoblast which is more accurate than the term chromatophore.

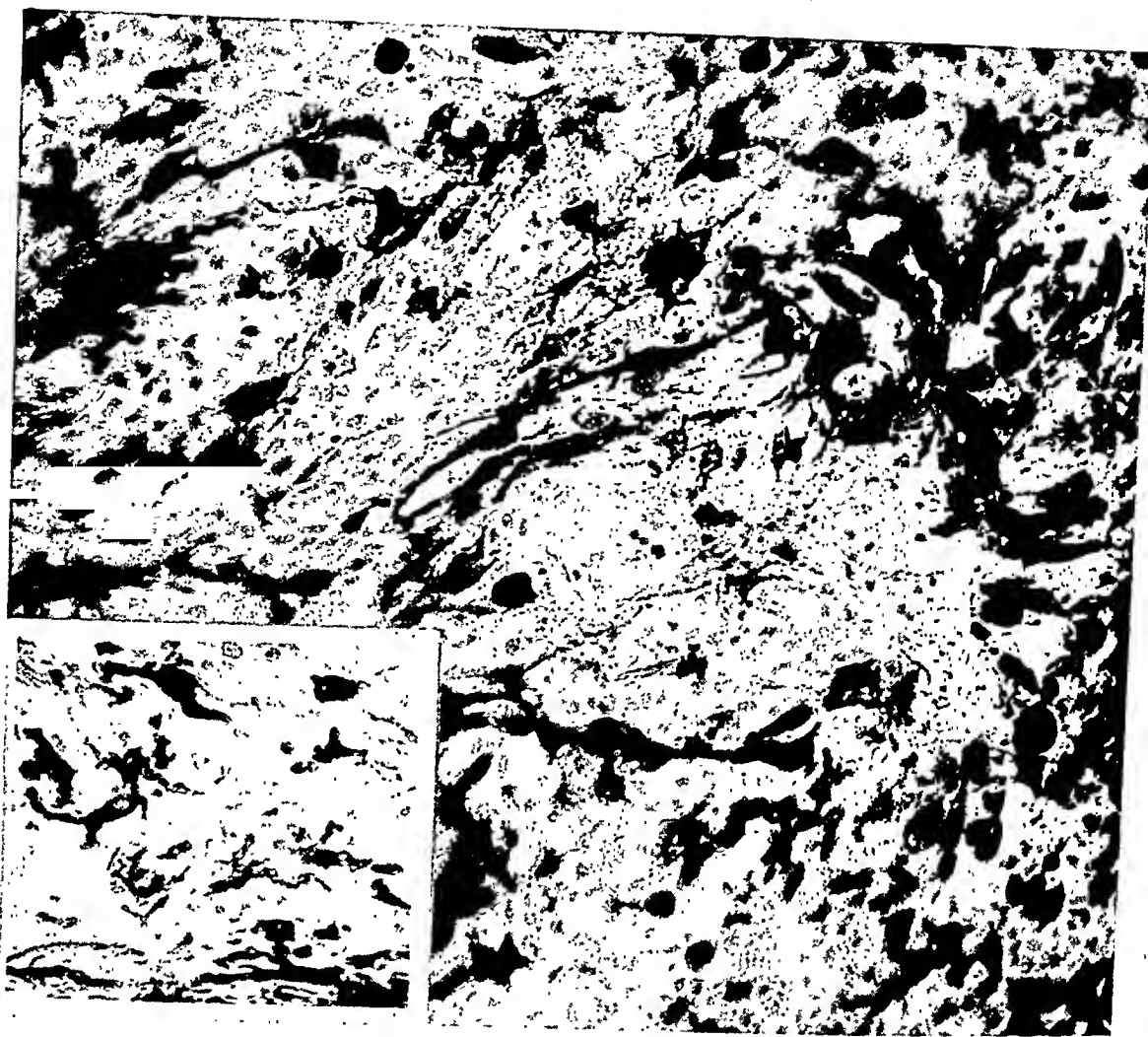


Fig. 15 (Reese). A MALIGNANT MESODERMAL CHROMATOGENIC MELANOMA OF THE CHOROID. The inset shows the normal chromatoblasts of the choroid. The close resemblance of the tumor cells to the normal uveal chromatoblast can be seen. (Hematoxylin and eosin stain.)

It is generally agreed that the uveal tract is mesodermal in origin. The only other site besides the uveal tract where these mesodermal chromatoblasts occur is subcutaneously as atavistic remains of a pigment system. In higher animals, including the monkey, there is normally and constantly present a subcutaneous pigment system composed of long, branching, mesodermal melanoblasts.

This pigment system of higher animals disappeared in the evolution of man except at one site in the region of the sacrum. This formerly was called the Mongol spot because it was thought to be found only in the Mongolian and Negro

racess. However, it is known now that this pigment system is found regularly over the sacrum, at least microscopically, in all races in the first year of childhood and disappears after about the fourth year. The spot is first seen in the fourth to fifth embryonal month, even before the pigment in the skin appears. The number of cells and their pigmentation increases at birth and for sometime thereafter. The cells are gradually lost and are seen only exceptionally in adult life. In the Japanese, Jijima⁵² found in all of 25 cadavers evidence of the spot after adult life. The characteristics and behavior of the spot are the same in both the Mongolian and

Caucasian races except in regard to degree. Furthermore, these pigmented cells at their particular site constitute a normal finding during a certain period of life in both the Mongolian and Caucasian races and, therefore, we are dealing solely with the amount or degree of a physiologic occurrence. Clinically, the sacral spot is a localized, bluish pigmentation in an otherwise normal-appearing skin. Microscopically, it is composed of long, branching, pigment cells normally arranged and spaced deep in the cutis with a pigment-free stratum of connective tissue between it and the epithelium. This gives a bluish color to the skin.

Sometimes such blue areas under normal-appearing skin, identical in appearance to the sacral Mongol spot, are seen elsewhere over the body singly or multiply and with or without the spot at the sacrum. Such lesions are called extrasacral Mongol spots.

The sacral spot is viewed as a physiologic variation comparable to the variation in the amount of pigment seen in the iris stroma. The extrasacral spot is viewed as a rest or rudiment of the pigment system normally present in higher mammals but which in human beings has disappeared except in the sacral region.

The blue nevus (Tieche-Jadassohn) consists of a localized compact tumorous mass of mesenchymal melanoblasts simulating in location and appearance the melanoblasts seen in the sacral and extrasacral Mongol spot. The differentiation between an extrasacral spot and a blue nevus may not always be sharp. If the melanoblasts do not form a definite, localized tumor mass but merely an irregular structural arrangement, then there may be some doubt as to the proper designation of the lesion. Practically, however, the difference is merely that in the one we are dealing with a congenital rest of a system only rudimentary in

man; whereas, in the other we are dealing with a benign growth originating from this rest.

The extrasacral spot and the blue nevus are seen principally on the face and extremities and may appear on the lids and bulbar conjunctiva. In an analysis of the microscopic sections of 50 cases of nevus of the conjunctiva, I found that 4 percent were composed of long, branching, pigmented cells which were interpreted as mesodermal chromatoblasts similar to the type found in the uveal tract. From this analysis it seems that the extrasacral Mongol spot and the blue nevus can appear under the conjunctiva as well as under the skin.

Montgomery and Kahler⁵³ have reported on 65 cases of blue nevus occurring in 62 patients. Thirty-eight of the lesions were studied histopathologically. They feel that blue nevi are relatively common and, if looked for, they will be found much more frequently than the literature would indicate. The onset in infancy or in early childhood of a firm, blue to blue-gray papule or nodule remaining as such, without increase in size, usually permits a clinical diagnosis of blue nevus. A malignant change is rare, and, when it occurs, it is a relatively slow-growing melanosaarcoma.

Laidlaw² and others have shown that the pigmented cells composing the sacral and extrasacral spots, as well as the blue nevus, are true melanoblasts. They, therefore, represent the only instances of mesodermal melanoblasts outside the uveal tract. Tumors arising from these cells are the only melanotic tumors to which the name "melanosaarcoma" can be correctly applied.

Smith⁵⁴ from his tissue-culture studies, found two types of pigment-producing cells in the human being. The one grew like connective tissue and the other like epithelium. The connective-tissue type

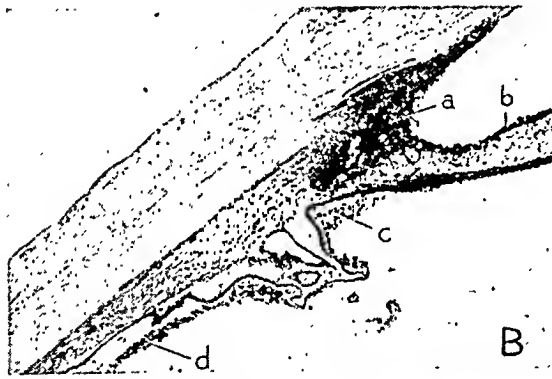
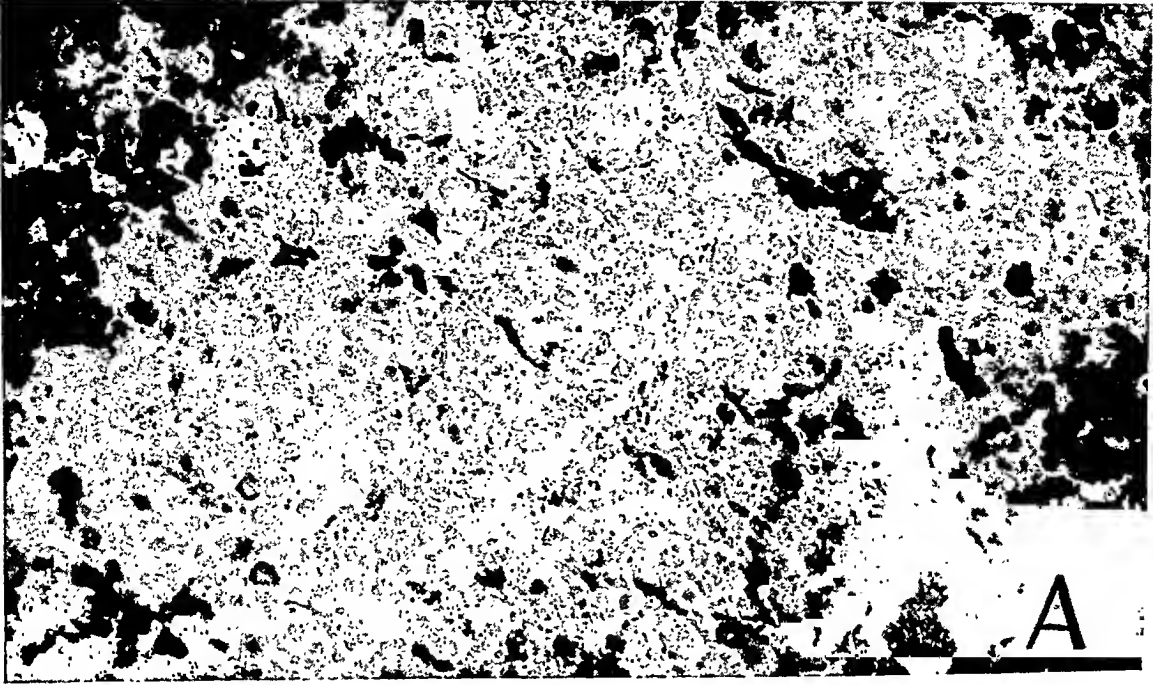
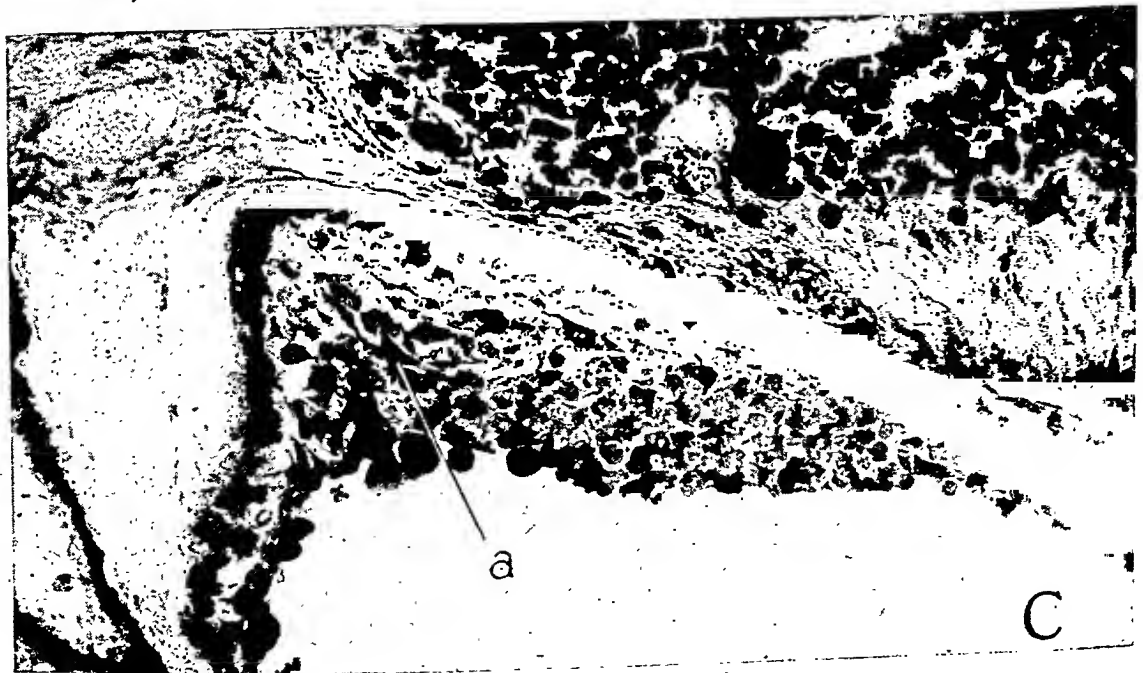


Fig. 16 (Reese). AN ANAPLASTIC MALIGNANT MESODERMAL chromatogenic melanoma of the ciliary body. A. Anaplastic cells with the tendency for the densely pigmented cells to lose their processes and become more or less globular. B. Implantation growths to the side of the eye opposite to the mother site of the tumor. Implanted tumor tissue seen in filtration angle (a), along anterior surface of iris (b), in posterior chamber (c), and along the surface of the ciliary body (d). C. A high-power magnification of the implantation growth in the posterior chamber (B-c). These implanted tumor cells show the morphologic characteristics of chromoblasts of the uvea. At (a) is seen a typical branching uveal chromatoblast. (Hematoxylin and eosin stain.)



was found in the choroid, ciliary body, iris, and Mongol spot. The epithelial type was found in the skin, hair follicles, retina, and brain. Of 250 benign pigmented tumors of the skin, he found 96 percent to be epithelial and 4 percent connective tissue. Of 100 malignant pigmented tumors of the skin, he found 67 percent epithelial and 33 percent connective tissue. As pointed out by Stout⁵⁵ his criterion for the malignant group could be criticized on the ground that epithelium can form spindle cells. It is interesting to note that Smith⁵⁴ gives an incidence of 4 percent for the mesodermal melanoblasts which is the same percentage I found from the histologic study of conjunctival nevi.

It is generally accepted that the uvea is mesodermal. The uvea is composed, therefore, almost entirely of melanoblasts which are mesodermal. It is highly improbable that all the melanomas of the uvea are neurogenic or ectodermal, and that no tumor stems from the bulk of the uvea which is the mesodermal chromatoblast. Also, the extremely wide variation in the structure of uveal melanomas indicated by Callender's classification⁵⁶ of spindle cell A and B, fascicular, necrotic, mixed, and epithelioid suggests that in

this group may be included more than one type of melanoma. A similar suggestion is the wide range in mortality, from 6 to 10 percent to 70 to 80 percent, quoted by Callender, Wilder, and Ash⁵⁶ according to argyrophil-fiber content and cytology.

As the result of a study of 410 melanomas of the uvea available in our collection, I feel that, in addition to the neurogenic melanoma already discussed, there is also a chromatogenic melanoma. The cell type of the latter is the mesodermal chromatoblast which gives rise to tumors in the form of benign or malignant chromatogenic melanomas. The cell composing the tumors has, for the most part, the characteristics of the chromatoblast normally identified with the uvea (fig. 15-insert). It is a branching cell which seems to have a tendency to become more globular and lose its processes with an increase in the pigment content (fig. 16-A). In the malignant tumor, there will be found all phases from the typical cell just mentioned to the anaplastic types (fig. 16). These latter cells show a rather large nucleus with a large nucleolus, great variations in the size of the nucleus with a tendency to giant-cell formation, no limiting membrane at the border of the protoplasm, and a tendency for the cells

TABLE 1
CONTRASTS IN THE TWO TYPES OF MELANOMA

	Neurogenic Melanoma	Chromatogenic Melanoma
1. Incidence	++	+
2. Meridian	More often horizontal	No predilection
3. Shape of growth	Flatter	More globular
4. Character of growth	Palisading of nuclei Fascicular and syncytial growth Glandlike arrangement of cells Large cystic spaces Horizontal line in nucleus Nevus cells	Transitional cells from characteristic branching cell to anaplastic cell
5. Pigmentation	+	++
6. Necrosis	+	++
7. Stroma	Large vascular channels	Fine connective tissue septa
8. Disseminated growth	No	Yes
9. Multiple sites	Yes	No
10. Mortality	+	+++

to grow in rows between fine connective tissue septa. The less anaplastic cells may tend to abut on the stroma suggesting the formation assumed by steel fragments towards a magnetic surface.

Table 1 contrasts the two types of uveal melanoma.

COMMENTS ON TABLE 1

1. An analysis of our cases showed that the neurogenic melanoma was twice as frequent as the chromatogenic melanoma.

2. When the neurogenic melanoma involved the choroid, it was twice as frequent in the horizontal meridian as elsewhere. This is thought to be due to the fact that the long ciliary nerves, which seem to be particularly susceptible to benign and malignant pigmented tumors, course in this meridian.

3. There was no great difference in the shape, but generally the neurogenic melanoma was flatter.

4. Rarely the neurogenic melanoma showed a glandlike arrangement of the cells resembling a carcinomatous growth (fig. 4-D). Rarely cystic spaces were present (fig. 5-D). The nuclei sometimes showed a central longitudinal line down the center which was thought to be due to a pyramidal shape of the nucleus.

5. Pigment formation was frequently associated with necrosis.

6. The greater incidence of necrosis in the chromatogenic melanoma is probably a factor in the greater incidence of pigment.

7. The large vascular channels with their accompanying connective tissue constitute the stroma in the neurogenic melanoma.

8. The neurogenic melanoma does not show disseminated growth occasioned by desquamated tumor cells. Such implantation growths away from the primary tumor site are common in the chromatogenic melanoma, especially when the

tumor involves the ciliary body and iris (fig. 16-B, C).

9. The neurogenic melanoma is frequently associated with lesions of the ciliary nerves, such as enlargement of the nerves on the side of the tumor (fig. 5), benign pigmented lesions of the nerve coursing to the site of the tumor (fig. 6), and benign pigmented lesions in the eye away from the site of the malignant lesion.

10. The prognosis of the neurogenic melanoma is much better than that of the chromatogenic melanoma. This is particularly true when the neurogenic melanoma is closer to the peripheral-nerve type (neurinoma or neurilemmoma) than it is to the nerve-terminal type.

Callender has reported on the prognosis of uveal melanoma according to cell type which he divides into spindle A and B, fascicular, necrotic, mixed, and epithelioid. It seems fair to assume that: (1) his spindle cell A and B and fascicular represent mostly neurogenic melanomas which had a mortality of 20+ percent; (2) his necrotic, mixed, and epithelioid were mostly chromatogenic melanomas which had a mortality of 60+ percent.

No effort to date has been made to determine the relative argyrophil-fiber or reticulum content of the two types of melanomas.

CONCLUSION

I have discussed in this presentation tumors which seem to differ genetically, histologically, and clinically but all of which have one factor in common; that is, pigment. However, this one factor is so conspicuous that it tends to dominate the histologic, as well as the clinical picture. I believe that, were it not for this prominent pigment factor, these tumors would be recognized as differing in fundamental respects, including prognosis. Is it not time, therefore, that we cease calling all tumors which harbor pig-

ment "melanomas" and attempt to designate their separate entities? The following is their separate entities? The following is suggested terminology:

1. Tumor arising from the Schwann cell and the nevus cell Benign and malignant neuro-genic melanoma.
2. Tumor arising from the pigment epithelium of the retina and ciliary body Benign and malignant neuro-genic melanoepithelioma.
3. Tumor arising from the dilator and sphincter muscles of the iris Leiomyoma.
4. Tumor arising from the pigment epithelium of the iris Dictyoma.
5. Tumor arising from the basal layer of epithelium Precancerous and cancerous melanosis.
6. Tumor arising from the mesodermal chromatoblast (uvea, sacral and extrasacral mon-gol spots) Benign and malignant chro-matogenic melanoma.

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THE TREATMENT OF RETINITIS PIGMENTOSA WITH SPECIAL REFERENCE TO THE FILATOV METHOD*

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The articles of Filatov and Verbitska¹⁻⁶ and their co-workers, which have appeared in the Russian literature, and which have been partially reprinted in this country in the *American Review of Soviet Medicine*, have again served to focus attention upon the treatment of retinitis pigmentosa.

There has been so much publicity in the lay press, and there have been so many inquiries from physicians and others, that a review of this material, and of other forms of therapy, seems to be in order.

Duke-Elder⁷ prefaces his chapter on the treatment of this condition with the statement, "that the treatment of retinitis pigmentosa is most unsatisfactory, and, indeed, may be said not to exist."

SURVEY OF THERAPEUTIC METHODS

USE OF MEDICAL DILATORS

The association of choroidal sclerosis and attenuation of the retinal arteries has served to focus most of the therapeutic attempts in the direction of obtaining

vasodilatation in the retina. These have consisted of subconjunctival injections⁸ of salt solutions and other substances, inhalations of amyl nitrite and nitroglycerin, paracentesis, the use of miotics, decompression operations, administration of nicotinic acid, retrobulbar atropine injections, and the use of acetylcholine.

USE OF SURGICAL PROCEDURES

It was only natural that the "transient successes" of the medical dilators should be followed by an attempt to obtain more permanent "improvement" by a surgical approach. For a long time, the section of the sympathetics to the eye, by various surgical procedures, was thought to be the answer; and this too has been discarded. Levine⁹ quotes Zehnder as saying, in 1879, that he had noted temporary improvement in cases of retinitis pigmentosa after treatment; but that in no case was this improvement long maintained, and "in no case and through no remedy has there resulted an even transitory improvement in eccentric vision, or enlargement of the contracted visual field."

Dor,⁹ in 1873, and Gunn,⁹ in 1881, both

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thought that they saw an improvement in fields and central visual acuity after the use of the constant current. Strawbridge⁹ felt that the current was of no help. Hall,⁹ in 1884, utilized subcutaneous injections of strychnine and administered pilocarpine orally in the treatment of retinitis pigmentosa, and thought that he noted improvement. Redslob,⁹ in 1906, thought that he noted improvements after the subconjunctival use of saline.

Mayou¹⁰ after the trephination of one case of retinitis pigmentosa, which did not have an increased tension, reported, in 1914, "gratifying improvement in the vision and fields." He said that "it is a well-known fact in retinitis pigmentosa that anything which improves the circulation will temporarily improve the vision; for example, amylnitrite, subcutaneous injections, paracentesis of the anterior chamber. Trephining flushes the vessels with blood. However, these eyes that are operated on, either for the removal of cataract or for trephining, have a great tendency to form fibrous tissue." A year later, Mayou had to report that the improvement in the case just mentioned was transitory, and that in spite of trephination, the disease had progressed.

USE OF GLANDULAR EXTRACTS

In 1918, Jones⁹ thought that he noted improvement after the administration of thyroid-gland extract. Rabinowitz,⁷ in 1931, reported on a series of eight patients, treated with inhalations of amyl-nitrite, as suggested by Imre. His period of observation was but 2½ months. Each patient received from 1 to 10 inhalations daily. He reported improved vision (from 0.4 to 0.85) in six patients; enlarged fields in four, with improvements of from 15 to 20 degrees; and improved dark adaptations in four. There were no demonstrable fundus changes.

Wibaut,¹¹ in 1931, introduced the use

of the female hormone. He reported enlargement of the fields and increased light sense. Of five patients treated, one was greatly improved, two moderately improved, one slightly improved, and one unaffected. Wibaut based his use of this form of therapy on the assumption that retinitis pigmentosa was more common in men and milder in women; hence, he felt that the female genital glands exerted a particular resisting power against retinitis pigmentosa. The preparation which he used was Menformon.

Biro¹² stated that he had noted in some patients of both sexes that at puberty a transitory improvement had taken place in their retinitis pigmentosa. He assumed that this resulted from an increased metabolism and a strengthening oxidative energy, due to the fact that the sexual glands have just started to increase in function. Between the years 1932 to 1938, he treated 35 cases with amylnitrite, sex hormones, and liver extracts. He treated 5 men with testicular extracts; 3 women with glandubolin (a follicular extract); 1 woman with liver injections; 13 patients with amylnitrite inhalations (7 men and 6 women); and 5 men with a combination of amylnitrite inhalations and liver injections. He felt that those with dominant heredity are more responsive to treatment.

Of the five men treated with the testicular extracts, four were said to have been improved. Of these four, the vision of one improved from 5/50 to 5/10. This man was said to have retinitis pigmentosa since pigmento. Another patient improved "subjectively." Two others had increases in fields, with return of temporal seeing sectors. In one of these, the field return was quite marked.

Of the three women treated with glandubolin, only one was improved; although another claimed "subjective" improvement. The vision of the one woman

was said to have improved from 5/70 to 5/30. The patient treated with liver extract showed an increase in visual field.

Of the 13 patients treated with amyl-nitrite, 5 were improved. One had a return of vision in the area of the ring scotoma; two had a return of temporal seeing sectors; and one had an improvement of vision from 5/30 and 5/70 to 5/15; another from 5/12 to 5/8; and a third, dramatically, from finger counting to 5/70.

Of the five men receiving both amyl-nitrite inhalations and liver-extract injections, two were said to have improved; vision in one improved from 5/30 to 5/20; in the other from 5/60 to 5/30. These two men had a return of temporal seeing sectors.

Biro felt that field tests are more important than visual tests in evaluating results. Since he did not make any note about changes in dark adaptation, the assumption is that this test was not done. He concluded his treatise with the statement: "But any one of the methods, either the dilating of the arteries or the raising and stimulating of the retina, is capable of improving in some instances, and, even then, to a slight extent. Not so much that it were apt to arouse hope, but at least in such a measure that it would be a mistake to pass over it indefinitely." It is unfortunate that Biro did not give specific data as to the length of follow-ups on his patients.

USE OF AMYLNITRITE AND ATROPINE SULPHATE

Krilloff, Levine, and Tropishko,¹³ in 1934, reported on the treatment of optic atrophy and retinitis pigmentosa by the use of amyl-nitrite, and, later, retrobulbar injections of 1:1,000 atropine sulphate. They noted that the inhalations brought temporary improvement in three of their nine cases of retinitis pigmentosa. When

these same patients were later treated with the atropine injections, they were said to have shown more marked improvements. No conclusions as to the efficacy of the treatment were drawn, although these authors felt that atropine was the better of the two drugs in their hands.

Abadie,⁷ in 1923, introduced the use of retrobulbar atropine injections for the treatment of optic atrophy. Folk¹⁴ used retrobulbar injections of atropine on a large series of patients with optic atrophy and on two patients with retinitis pigmentosa. While he claimed improvements in his optic-atrophy cases, he felt that, in retinitis pigmentosa, atropine has only a temporary effect and has to be repeated. One of his patients with vision of 20/200 and 10/200 showed no improvement. The other, with an initial vision of 3/200 and 8/200, improved to 12/200 and 20/200, only to fall back to his original level within six months.

Brown¹⁵ utilized the same approach in treating six cases of retinitis pigmentosa, half of which were considered to have been improved. Brown's series had an average two-year check. In one case with minimal involvement, the small scotoma in the fields disappeared early in the course of treatment, and had not returned when re-examined two years later. Vision in another case improved from 20/100 and 20/50 to 20/40 each eye. When re-examined two years later, vision was 20/20 and 20/30+2, with larger fields than at the time of the initial examination. A third case, with vision of light perception in each eye, was improved to 20/200. This vision was maintained two years later, but the fields had decreased. A fourth case, with vision of 20/50 and 20/100, improved to 20/40 and 20/100; but after two years had gone to 20/100, O.U. A fifth case with light perception in each eye did not improve. His last case had vision of 20/50 in each eye, with a

heavy ring scotoma. Vision in this case improved to 20/30 and 20/50+1. After four months, vision in the right eye dropped back to 20/50, but after more treatment, improved to 20/30. Two years later, this patient's vision was 20/30-3 and 20/40.

USE OF HORMONES AND VITAMIN D

Giambattista¹⁶ utilized the melanophoric hormone of the pituitary gland, both by topical application and by injection, and claimed improvement in dark adaptation. Arthur A. Knapp¹⁷ noted a retinitis-pigmentosalike change in animals after feeding them a low vitamin-D, low calcium diet. He treated nine patients with retinitis pigmentosa by administering high doses of viosterol and calcium-phosphate tablets; and reported, "definite subjective improvement in all." In five cases, the discs became pinker, and the caliber of the arterioles "seemed to be widened." He had similar results with this treatment in myopia.

VITAMIN-A THERAPY

The well-known association of vitamin A and symptomatic night blindness; plus the known fact that the retina is the richest of all the body tissues in vitamin A; plus the additional fact that the rods, which are the hardest hit of all structures in retinitis pigmentosa, are the richest repositories of vitamin A in the retina, has inevitably led to the use of this vitamin in the therapy of symptomatic night blindness and of retinitis pigmentosa. The success of vitamin A in treating night blindness, not associated with visible disease of the retina, is not the concern of this article.

Levine⁹ stated: "It has yet to be shown that the retina in a case of retinitis pigmentosa is deficient in vitamin A." He used cod-liver oil, by mouth, in large

doses, in the treatment of this condition and was at first enthusiastic about its use. Five years later, he had to admit that the improvements were only temporary.

Givner¹³ has studied a group of 15 patients from the viewpoint of vitamin deficiencies, and has found a lack of vitamin C, only. He has not found any improvement after its administration. He was unable to prove any disturbance in liver functions.

"Satanowsky," in 1934, noted that a deficiency of vitamin A, in retinitis pigmentosa, leads to a disturbance in the regeneration of the visual purple, which may be the cause of secondary atrophy of the rods and cones; because visual purple is necessary for their proper function. Being aware of the role of the liver in the exchange of vitamin A, Satanowsky thinks that the disorders of the liver may be the cause of pigmentary degeneration of the retina."

Parker¹⁹ has recently discussed the role of infectious hepatitis of a chronic nature in the production of night blindness. He found subnormal adaptations in six patients with severe chronic infectious hepatitis, and normal readings in six with mild hepatitis. He gave 3 of the 6 patients with the reduced dark adaptation, 40,000 units (U.S.P.) vitamin A daily, and in one week all showed marked improvement. "Two patients had jaundice during hospitalization, and there was only a slight alteration in their dark-adaptation readings, which were well within the range of error of the tests." Filatov quotes Blegvad as successfully treating hemeralopia and cirrhosis, which appeared with cancer of the liver in a case in 1923, by the parenteral administration of vitamin A.

Josephson²⁰ felt that "one of the fundamental features of the pathologic physiology of the disease is failure of utilization

of carotene and vitamin A." He attempted to treat retinitis pigmentosa by the oral administration of these substances, but noted no improvement. He then gave 30,000 to 60,000 units (new U.S.P.) of carotene in oil, intramuscularly, one to three times per week, and "was gratified to find a rapid and prompt response and relief of the night blindness." He stated that in all the early cases, he noted improvement within a week after starting treatment; "and dark adaptation became comparable to normal, within one to four months, normal in some cases, with a corresponding improvement in the night blindness." He did not note improvement in the more advanced cases with extensive chorioretinal atrophy. He felt that his findings indicated the failure of assimilation of vitamin A and its precursors as an etiologic factor in retinitis pigmentosa.

Litvak² and Verbitska have used Avital, a vitamin-A preparation, intramuscularly, without any results. In March 1938, Tscherkes²¹ (also spelled Cherkes) treated one case of retinitis pigmentosa after the manner of Josephson, and reported marked improvement in dark adaptation. Litvak and Verbitska attempted the use of Avital in another case, in 1938, and noted disappearance of the hemeralopia, and improvement in dark adaptation. Improvement was still present when the adaptation was investigated two months later.

REDUCTION OF INTRAOCULAR PRESSURE

In 1936, at a meeting of the German Ophthalmological Society, Lauber²² reported on the treatment of optic atrophy and of retinitis pigmentosa by the reduction of the intraocular pressure. He discussed the relation between blood pressure, intraocular pressure, and intracranial pressure. He felt that if the blood pressure was lowered or low, in patients

with tabes, optic atrophy tended to develop during these periods of lowered pressure; and that with a return of the pressure to normal, the atrophic process comes to a standstill. He also felt that the disastrous effects of certain antisyphilitic drugs was due to the fact that these lowered the blood pressure. He reasoned then, that two sources of treatment were available: either to raise the systemic blood pressure or to lower the intraocular pressure. He stated that it had been possible to bring the pathologic process to a standstill, in many cases, by medically or surgically lowering the intraocular pressure. At the same time the general condition of the patient was improved by the use of strychnine and various glandular preparations. Failure was due to inability to achieve this aim.

The same treatment was applied to 21 eyes with retinitis pigmentosa, most of them far advanced; in 14 eyes, vision "improved," and in more than "half of these, the visual fields too became larger." In some eyes, the improvement lasted more than six months. In five eyes, the condition has remained unchanged, after improvement for a time in one eye; in two eyes, a temporary improvement was followed by a worsening, with recurrence of the ocular hypertension. He stated that retrobulbar injections of atropine should be deleterious, due to the creation of a hypertension.

Sobanski²³ used a similar approach to the problem, employing cyclodialysis plus strychnine. He treated nine cases with seven improvements, three of which were temporary.

Levy-Wolff²⁴ quotes Nizetic, Spiridonovic, and Bukorov as having treated three cases by sympathectomy, plus pilocarpine or cyclodialysis for pressure. They obtained improvement only if they used the tension-reducing measures.

PERMANENT DILATATION OF RETINAL VESSELS

It was inevitable that a more central approach to the problem should be instituted. In 1930, Royle²⁵ reintroduced the concept of producing a permanent dilatation of the retinal vessels by employing a section of the sympathetic nerve supply to the eyes (Duke-Elder credits Abadie with having first suggested the idea in 1901). Royle's suggestion was greeted with considerable enthusiasm; and the method, if one is to judge from the literature, was attempted universally.

Various surgical approaches and techniques were employed, in an attempt to obtain a more perfect result. Royle practiced division of the branches of the first thoracic ganglion and removal of the ganglion. Caeiro, Malbran, and Balza²⁶ also employed a similar procedure which they refer to as "stellotomy." Meighan²⁷ performed a resection of the superior cervical ganglion, plus periarterial sympathectomy of the carotid artery. McKenzie²⁸ performed a similar procedure, plus a resection of the middle cervical ganglion. According to Whitnall,³⁰ superior cervical ganglionectomy should suffice to insure a complete denervation of the sympathetics here.

The underlying rationale behind any form of sympathectomy was the hope that an exaggerated vasomotor tonus was responsible for the attenuation of the retinal arteries. The permanency of the vasodilation, after sympathectomy, is still a matter of dispute. While the immediate effect of the sympathectomy is vasodilation, vascular tonus is regained within a few weeks.

In his first paper, Royle reported on six cases treated with sympathectomy. Vision in the first patient was not even hand movements at four feet. Two weeks postoperatively, this man could tell time on a clock and, finally, six weeks postopera-

tively, he was able to read typewritten letters. Vision in the second case was 6/60; and fixation was too poor to enable a field to be taken. One- and one-half months postoperatively, the patient's vision was 6/60 and 6/36. The report on four other patients was "too early to state the results accurately," but some improvement in vision and fields was shown.

In 1932, Royle reported on 15 cases. Dr. E. A. Brearley was quoted by him as noting that the ipsilateral retinal vessels were almost invariably dilated postoperatively, and that this was permanent. Nine of Royle's cases had had loss of central fixation for years; and in none of these was permanent improvement noted.

In the other five cases seen by Dr. Brearley, four patients had maintained their improvement, and one had lost ground after an immediate response. The results in these five cases, plus a sixth, seen by another ophthalmologist, were:

Case 1. Vision was 6/60 in each eye. Fields were unchartable. Five months postoperatively, vision was 6/60 and 6/24, and fields were within 10- to 20-degree circles.

Case 2. Vision was 6/6 in each eye. There were 20- to 30-degree fields postoperatively (17 months), vision was unchanged. Fields had enlarged to almost normal.

Case 3. Vision was 6/60 and 6/18. The right field was less than, and the left slightly more than, 10 degrees. Three months postoperatively, vision had increased to 6/36 and 6/12, and then returned to original preoperative vision. The left field was slightly enlarged.

Case 4. Vision was 6/60 in each eye. Fields could not be charted. Two months postoperatively, vision was 6/24— and 6/60. Field for the right eye was 10 degrees.

Case 5. Vision was 6/60 in each eye. Fields were to the fixation point. Three

weeks postoperatively, vision was 6/36 and 6/60. The right field had increased to between 10 to 20 degrees.

Case 6. Vision was 6/24 in each eye. There were 10-degree fields. Ten months postoperatively, vision was 6/9 in each eye. Fields had increased to 18 degrees. (Case of Dr. C. Thomson.)

Royle cited the recovery of hearing in one mute; and an improvement of hearing in one case of deafness. Royle's fields are open to question, in that they show concentric enlargement as a sign of improvement. It has been my experience, as well as that of a large number of the authors quoted here, that where improvement in the field occurs, it frequently is in the direction of return of peripheral (usually temporal) seeing areas. Royle's series includes no such case, even though he has cited large improvements in some of his cases.

MacDonald and McKenzie,²⁸ in 1934, reported on four cases treated by sympathetomy, with the following findings and results.

Case 1. Vision was 5/60 and 6/60+1. Fields were down to fixation. Twenty-six months postoperatively, vision was 6/60 and 5/60. Fields remained unchanged.

Case 2. Vision was 6/60 and 6/36. Fields were between 20 to 30 degrees. Twenty-four months later, vision was 6/36 and 3/60. Fields have decreased to the 5-degree circle.

Case 3. Vision was 6/24 and 6/12. There were 5-degree fields. Twenty-four months postoperatively, vision was 6/24 and 6/12, and there was a slight increase in fields.

Case 4. Vision was 6/12 and 6/24. Fields were 15 to 20 degrees. Six months postoperatively, vision was 6/12 each eye, and the right field had definitely increased.

In this series, one eye definitely shows

an increase in vision and field; and, conversely, one eye (case 2) shows a marked decrease in vision, postoperatively.

Campbell²⁹ reported one case with vision of 6/12 in each eye, and with 3-degree fields. After sympathetomy, vision remained unchanged, although there was a return of a superior seeing island in the field. This disappeared after six months.

Walsh and Sloan³⁰ reported three cases, in 1935, which were treated by sympathetomy. The findings in their series were:

Case 1. Vision was 20/40 in each eye. Five-degree fields were present. There was no improvement postoperatively.

Case 2. Vision was 20/50 and 20/40. Fields were 17 to 20 and 12 degrees. One month postoperatively, vision was 20/70 and 20/50. Fields were unchanged.

Case 3. Vision was 20/200 and 20/30-3. Right vision was corrected to 20/100. The patient was unable to read Jaeger type with the right eye. Left vision was J1 at 6 inches. This patient was carefully followed for a period of 14 months, and no improvement in vision was noted, despite her assertions of visual improvement. There was definite improvement in fields and in dark adaptation, but eventually there was a return to preoperative levels.

Meighan,²⁷ who, at the 1931 congress of the Ophthalmological Society of the United Kingdom, had reported on one case improved by sympathetomy, again reported on the same subject, in 1935. At that time, he stated that the original case had now regressed to the point where the patient was worse than before treatment. Two other cases had been similarly treated; one showed slight improvement in vision; but both showed progressive contraction of the fields. Meighan felt that this progressive contraction of the

fields indicated that the disease had not been arrested.

Gifford and de Takats,³¹ in 1935, reported on six similarly treated cases.

Case 1. Vision, corrected, was 6/12 in each eye. There were 20-degree fields. Postoperatively, vision was 6/10-1, with no change in fields.

Case 2. Vision was 8/10 in each eye. Fields were within 10-degree circle. There was no change, postoperatively.

Case 3. Vision was 18/200 and 20/200. Fields showed loss of the upper half and a central scotoma on each side. Operation did not improve the condition.

Case 4. This case had previously received 10 subcutaneous injections of uveal pigment, with no change in her findings. Vision was 20/40 and 20/20-3. Postoperatively (5 to 8 months) vision was 20/40+2 and 20/15-2. Visual fields had contracted.

Case 5. Vision was 20/20 and 20/40+1. Fields were 10 to 20 degrees. Postoperatively, vision was 20/40-1 in each eye, with a decrease in the right field.

Case 6. Vision was finger counting and 20/50. There was no change after surgery.

These authors felt that their results definitely failed to confirm the enthusiastic reports in the literature. They sounded a note of caution and pointed out that one of Magitot's patients had remained dizzy and had suffered occipital headaches for months, postoperatively.

In 1933, Caeiro, Malbran, and Balza²⁶ presented five patients treated by stelletomy. Their results follow.

Case 1. Vision was light perception and 1/8. Fields were 5 degrees. Vision showed a postoperative improvement to 20/20 (L.E.) 11 days later. The left field was increased to 15 degrees, temporally.

Case 2. Vision was 1/8, O.U. Fields showed 5 degrees. Three months postoperatively, vision was 1/3 and 1/4; fields had increased to 10 degrees.

Case 3. Vision was improved in two months from perception of large objects to 1/20. Fields were not done.

Case 4. Vision was 1/6 in each eye. It was improved in one week to 1/3 and 1/4. There was no improvement in fields.

Case 5. Vision was: R.E., large objects; L.E., 1/8. Fields were 5 and 10 degrees, respectively. One week postoperatively, vision was 1/50 and 2/3. The left field had increased to 20 degrees.

Two of these patients (cases 3 and 4) had been previously treated for syphilis.

In 1938, Caeiro³² again reported on the results of stelletomy. He quoted Campbell's and Meighan's good results; a claim not made by these authors, nor upheld by a review of their reports. He, at this time, also referred to three cases operated by Drs. Villegas and Pasman, who obtained "flattering" results. He did advise caution in the interpretation of results. He definitely felt, however, that "patients who have been operated on by this method have shown real improvement, and these results, whether based on quackery or on scientific principle, are eloquent."

It is probable that Caeiro did not intend the word "quackery" to be used in the American sense; but rather to denote lack of scientific rationale. Caeiro did not believe that the effect of ganglionectomy on the capillaries wears off after a short time; but quoted Diez to the effect that "experience has proved that with this operation the phenomena of vascular expansion that are obtained are persistent, or, at least, last a long time."

Caeiro divided his cases into two series. One series of 13 patients (including the four recorded above) were operated on without consideration of the degree of progress of the ailment. In addition to the four reported whose "increase in visual field and visual keenness" still persisted five years later, four had a slight improvement and four no change. The

last obtained much improvement in vision and field, "lost within six months almost all that he had gained; a slight improvement in visual keenness nevertheless persisted."

The second series included more carefully selected cases, all operated upon two years prior to publication of the article in 1938. The results in the second series follow.

Case 1. Vision was $1/3$ and $1/4$. Fields were 20 and 25 degrees. A month after operation vision in the left eye (operated) was $1/2$, and that field had been extended to 40 degrees. Data on the right eye were not given. It was stated that examination three months later still showed improvement.

Case 2. Vision was $1/5$ and $1/4$; fields were 50 to 70 degrees, and 0 to 60 degrees. Five months postoperatively, vision was $1/3$ and $1/2$. One field remained unchanged; the other went from an original of 0 degrees temporally to an increase of 50 degrees. Three months later when the patient was examined "he was found to be doing well."

Case 3. Vision was 0 and $1/10$. The field on the eye with vision showed 55 to 80 degrees, with a large central scotoma, covering 25 to 55 degrees of the central field. Examination almost three months after surgery revealed vision to be: ability to distinguish bulky objects and $1/6$. There was some increase in field.

Case 4. Vision was counting fingers at 3 meters and $3/10$. Fields were 25 to 50 degrees, L.E.; and contracted temporally to 50 degrees, R.E. Four months postoperatively vision was: the $3/10$ eye had increased to $1/2$; vision in the other eye was not given. Fields were essentially unchanged.

Caciro concluded with the statement that four other patients had been similarly treated, with good results, but were not being reported because the period since operation had been too short.

It is worth noting that Caciro has obtained unusually large fields on patients with poor vision. At the same time, it should be pointed out that he did not elicit any ring scotomas in his preoperative examinations. Nor did he elicit any such scotomas on examination of any of his improved cases.

Kerr,³³ in 1935, reported on the series of cases which he had operated for Dr. Louis Greene. They saw 18 patients with retinitis pigmentosa, five of whom were blind. Of the remaining 13 patients, only eight showed fields. Of these eight, three patients who had good fields obtained excellent results; and the five with gun-barrel fields obtained no results.

Greene and Kerr's first case showed a 50-percent improvement in visual acuity; and 150-percent increase in field. Their second case had vision of $20/40$ and $20/70$, which was improved to $20/20$ and $20/30$, while the fields were improved to almost normal. Their third case went from $20/100$ to $20/20$ in each eye, with almost normal-field returns. Their fields, also, showed concentric enlargement without the ensuing return of a ring scotoma during the period of enlargement. They had one postoperative death, occurring the next day.

Grant,³⁴ at a meeting of the College of Physicians of Philadelphia, in 1940, reported on the late results of cervical sympathectomy in retinitis pigmentosa. He used the high operation of carotid stripping of the internals, common and externals, with excision of the upper and middle cervical sympathetic ganglia, and the intervening nerve. Reporting on nine cases, he stated that he thought that they became worse more slowly than did similar control cases which were not operated. Spaeth, in discussing this paper, tended to agree with Grant's findings; and commented upon the tremendous variability in the fields, postoperatively. He commented

upon the number of new retinal vessels seen postoperatively.

Zaven and Govaerts,³⁵ in 1940, reported one case similarly treated, with no improvement. Blobner,³⁶ following the reports of Magitot, which were enthusiastically in favor of sympathectomy, attempted this procedure on six cases. He obtained no improvement and felt that the operation should be done away with, since it did no good and could do harm.

Karsch,³⁷ in 1936, attempted a critical review of all the therapeutic procedures which had been attempted in retinitis pigmentosa, from 1887 to 1935, and concluded that nothing substantial had been added to our therapeutic armamentarium. He suggested that the work of the Japanese, Sgrosso and Sukanura, with roentgen therapy, be followed, as he felt that this might offer some hope.

Crisp,³⁸ in 1937, in an editorial on the subject of therapy of retinitis pigmentosa, quoted Doyne as having administered raw ox retina and sheep retina, without results. Clegg had tried a glycerine emulsion of sheep retina with similar negative results; while Seggel had combined injections of strychnine with the administration of cod-liver oil and liver.

In 1940; Mutch and Macky³⁹ commented on Dax's work with melanophore-dispersing hormones, and offered the suggestion that the B hormone, or melanophore-dispersing hormone, might offer some future hope. They were, however, unable to prove their point in several attempts on patients. Their results differed from those of Giambattista, referred to earlier in this paper.

The multiplicity of the therapeutic agents employed in retinitis pigmentosa, and their uniform failure to obtain or maintain a lasting improvement, plus the general failure of other observers to repeat successes claimed by the originators of these modes of therapy, indicate that,

today, retinitis pigmentosa must still be classed as a hopeless disease.

THE FILATOV^{1a} METHOD

Filatov and Verbitska have introduced the concept of "tissue therapy" for the treatment of retinitis pigmentosa and other ocular diseases, as well as for some nonocular conditions. They employ the intramuscular injection of cod-liver oil, as well as implantations of liver, skin, placenta, and other tissues under the skin. They have also utilized subconjunctival implantations of placenta, with or without a scleral trephination. They have treated over 110 patients by this method. It is the purpose of this paper to outline their methods of treatment, along with some comments as to their results; especially in view of our own experience with this method.

Filatov's theory is that, when tissue has been removed from the body under aseptic conditions and allowed to stand 6 to 7 days at $+2^{\circ}\text{C}$., certain disintegration substances are released.

These disintegration substances act as vital stimulants when the tissue is implanted or its extracts are injected. This action is not a specific one for any particular organ. He believes that it is this stimulation, and not the vitamin content alone, which produces beneficial results. Since each gram of U.S.P. cod-liver oil contains "not less than 850 U.S.P. units of vitamin A, and not less than 85 units of vitamin D," it would appear that for each cc. of the oil injected the vitamin content would not be very great. It would also appear that some other substance or substances in the material might well be credited with the results which Filatov claims.

METHODS OF PRÉPARATION

Filatov prepared his cod-liver oil by sterilization in a boiling water bath for 15 minutes, for three consecutive days. This oil was later poured into ampules,

and heated to 60 to 70°C., two hours daily, for three days. According to Filatov and Verbitska, sterilization did not destroy the vitamins and the liver products, and bacteriologic examinations were negative. They started with 0.5 cc. doses intramuscularly, and later increased the doses to 1 cc. and then to 2 cc., given three times weekly, with the series consisting of from 10 to 24 injections. Each injection was followed by two to three minutes of local massage.

Sterilization of the oil in ampules, with the addition of nitrogen to prevent oxidation, is the safest and best method of preparation. This is the method which we now employ, using a 1-percent-procaine base to prevent or minimize the delayed reactions, which have accompanied the use of cod-liver oil injections. With this preparation, larger doses are now being used.

Filatov has also used by implantation or injection many tissues, which he feels contain these "biogenic stimulators." He has found these "stimulators" in the skin, liver, spleen, subcutaneous tissues, muscle, cartilage, and in various eye tissues, as well as in the placenta. He has also found them in various plants; for instance, in the leaves of aloe and pea sprouts, which he conserves in the dark.

The material is removed from the bodies of persons, who have died from noninfectious diseases or from trauma, within 10 hours of death. It is removed under strictly aseptic conditions and stored in a dry-sterile bottle for seven days, at a temperature of 2 to 4°C. He states that all spirochetes have disappeared by this time, and quotes his colleagues, Walter and Glaiberman, as having shown by serologic and other tests in several thousand cases that no syphilis is present. He implants small pieces of tissue, principally liver or placenta, subcutaneously, usually in the subcostal region. These subcuta-

neous pockets are about 3 to 4 cm. in width, and the small fragments which he implants into them are equal to about 6 cc.

We have attempted one liver implant, without untoward effects. Of the first four specimens of human liver which we obtained at autopsy, three were rejected after having been cultured in deep broth for one week. Sterile liver can be obtained in the operating room.

"Subconjunctival implantations of placenta, and other tissues, is performed as follows. The material is refrigerated for seven days. After subconjunctival injection of 2 cc. of 0.5-percent solution of novocaine, to produce edema, a small incision is made in the conjunctiva, which is undermined at least 2 cm. A segment of placenta, 12 to 15 cu. mm., is introduced deep into the channel. With his forceps, the surgeon then grasps the placenta together with its overlying conjunctiva, and holds the two tightly for a few seconds to keep the implant in place. No sutures are required. This operation can be done in the out-patient department." Filatov has similarly implanted choroid and retina, cornea, and tarsal material.

Intramuscular injections of placenta and other tissues, are prepared by Filatov as follows. "Ten parts of distilled water are added to the finely macerated tissue and the mixture is kept for one hour at room temperature, and for another hour at 70°C.; it is then filtered several times. When the protein content does not exceed 6 mg. percent, the liquid is transferred to ampules which are kept at room temperature for three days, except for one hour daily during which they are tyndallized at a temperature not above 70°C. After testing for bacteria, the ampules are placed on ice."

APPLICATION AND RESULTS OF THERAPY

Filatov and his co-workers have used

this therapy in practically every eye disease and have claimed improvements and cures in many of these. Some of the conditions for which they have made such claims are: keratitis, conjunctivitis, blepharitis, corneal tuberculosis, herpetic keratitis, hypopyon keratitis, corneal ulcers and opacities, keratoconus, uveitis, myopic chorioretinitis, optic atrophy, glaucoma, and trachomatous pannus. It has also been used to increase function in healthy eyes when various somatic disturbances are present. A complete table of the results of Filatov and Verbitska's

TABLE 1

RESULTS OF SOME CASES OF RETINITIS PIGMENTOSA
TREATED BY FILATOV AND VERBITSKA

Method of Therapy	No. of Cases	No. of Successful Results
Injections of cod-liver oil..	60	52
Subconjunctival implants of placenta.....	22	22
Subdermal implants of placenta.....	6	—
Subdermal implants of preserved skin.....	5	—
Transplantation of skin...	17	7
Total.....	110	81

treatment of cases of retinitis pigmentosa is not available, but some of their results are shown in Table 1.

Filatov and his co-workers have recorded improvements in visual acuity, fields, and in dark adaptation. Their follow-ups, as recorded, have been brief, for the most part. However, he does note one improvement lasting seven months, and another lasting 2½ years. He has charted increases in both central and peripheral fields and increases in light sensitivity of from 5 to 1,000 times.

Filatov has also used combinations of the injections (usually of cod-liver oil) and the subdermal or subconjunctival implantations. He does not discuss in detail

the average duration of the "improvements;" nor does he discuss the question of a "maintenance dose." He does state that in cases in which the improvement has been lost he has been able to bring it back with another series of treatments.

DISCUSSION

A survey of the literature on the therapy of retinitis pigmentosa leaves the reader very confused. In spite of the vast array of therapeutic agents which have been presented in over half a century, the disease is still a hopeless one. The marked variation in results which different reliable observers have obtained with the same modes of therapy is difficult to explain.

As one reads the detailed descriptions of the various cases treated and of the results claimed, it becomes obvious that there is not a complete agreement on just what constitutes retinitis pigmentosa; on just what amount of "improvement" is an improvement; or on just what amount is a normal variation.*

Filatov's work on "tissue therapy" has been greeted with considerable skepticism in this country. This skepticism has been heightened by the fact that his reports have not been up to the American standards of scientific reporting either in detail or in the length of follow-ups.

I must admit that, when the subject was brought to my attention, my first reaction was one of skepticism. However, in spite of the fact that they are panacealike in nature, the claims of a man of Filatov's reputation merit study before being discounted. With that purpose in mind, a study of his methods has been embarked upon, and up to January 1, 1947, 109 patients suffering from typical or "atypical" retinitis pigmentosa have been, or are being, treated.

* The author intends to discuss this subject in a later article.

EXPERIENCE WITH FILATOV METHOD

It is not the intent of this article to serve as a preliminary report of the work which we are doing at the New York Hospital. However, some comments concerning our experience might be of value to others desiring to attempt this work. Our therapy was begun in June, 1946, and thus far (January 1, 1947) has been concerned mostly with the cod-liver oil injections or their modifications. Some of Filatov's other methods are also to be attempted.

Originally, a small series of patients was selected, with the idea of conducting a pilot experiment to determine whether the method warranted more intensive study. Since facilities for dark-adaptation tests were not available at that time, only one patient in this series had these tests. No study of this type would be complete without dark-adaptation determinations, which are now being done. Our studies included complete ophthalmoscopic and slitlamp studies of the eyes, with visual fields, visual acuity, and tensions. Special attempts were made to elicit ring scotomas and peripheral seeing areas.

As a result of the "improvement," noted in some of the original series, a more complete study on 109 patients is now being carried on. These improvements were in the direction of increase in visual acuity, of increase in field, and of gross improvement in ability to get about in poorly illuminated rooms, and so forth.

Many of these patients stated that they noted less need for dark glasses in the sunlight and that they had less discomfort in the sun. Others commented on the fact that "things are less hazy" and that their eyes were less tired. Incidentally, a common complaint of these patients is that of "tired eyes." Whether this is due to their habit of squinting or to the rapid exhaustion of the few patches of functioning retina which they have, or to both, is not

clear. This has not been stressed before as a common symptom.

One man who had to change his occupation because of his failing vision and who had formerly been an excellent badminton player, reported that he was again able to play a "good game of badminton." He also noted that he no longer needed his sun glasses when he was driving and gardening.

Another man who had had one eye enucleated stated that he had been unable to play ping pong for 12 years, because he had "missed 15 out of every 16 shots." He returned from his vacation, taken immediately after a course of 15 injections of the cod-liver oil, and stated that he was again able to play, and to "hit 15 out of 16 shots." Although some of the "improvements" were definitely psychologic in nature, one was impressed by the apparent reality of others.

In addition to an initial improvement in visual acuity, there is a tendency for the peripheral seeing area to return, or for the present one to enlarge. In our experience, this improvement has been almost always in the far temporal periphery. At this time, it is not possible to discuss fully the changes in dark adaptation, but it is our impression that dark adaptation improves in some cases. Changes of illumination cause these patients considerable suffering, and these treatments have given relief in some instances. Tolerance to light also improved in some cases. Most of the patients complain of "hazy" vision, and some have stated that this tends to clear.

TECHNIQUE USED

At present, a series of injections consists of initial doses of $\frac{1}{2}$ cc. to test sensitivity; followed by four injections of 1 cc., and 15 injections of 2 cc. or more. Injections are given three times weekly. Obviously, June, 1946, to January, 1947,

is too brief a time to permit extensive follow-up studies. However, the improvements in the cases treated have for the most part been of fairly short duration, lasting four to six weeks or a little longer. It is quite possible that we shall find the durations of improvement to be as variable as did Filatov.

The injection of cod-liver oil is not a simple mode of therapy. We have noted a number of local and some systemic reactions. The injection is not immediately painful and does not require the concomitant use of any local anesthetic. About 48 to 72 hours after the injection, a local reaction occurs; and, in some cases, fever and a chilly sensation. The effect seems to be cumulative. Areas which had been injected a week or more before may now start to become inflamed. On several occasions, it seemed that large abscesses were forming, but in each case, the reactions responded to local applications of heat or ice. Some patients have been incapacitated for as long as one week. We are under the impression that, the more the material is sterilized, the more severe the local reactions. Men seem to be able to tolerate the injections better than do women. The local reactions, at the site of injection, have varied from slight to severe. We have used the biceps region as well as the gluteal, with reactions being no greater in the former site than in the latter.

As this work continues, an attempt will be made to determine the irritating factor. Various preparations will be tried; namely, cod-liver oil without vitamins A and D; carotene and the various isomers of vitamins A, A and D, A and E; various other fish oils and their fractions, either together or in succession; and cod-liver oil concentrates.

Filatov states that he does not know the chemical nature of the substance responsible for the "biogenic stimulation." One

can only conjecture at this time; but it is important to note that the sterols are found in large quantities in most, if not all, of the substances which he mentions as sources of supply.

DISCUSSION OF EXPERIENCE

The first problem that confronts the investigator in this field is to determine the merits of this form of therapy. Assuming that there may be some merit in it, the next problem is one of determining the average duration of the improvement and the possibility of working out an adequate maintenance dose.

Further work, after adequately testing Filatov's methods, would then be in the direction of improving upon this means of therapy. In its present form, it is not the final answer to the treatment of retinitis pigmentosa.

An honest evaluation of any mode of therapy, which seems to offer hope of improvement in an appreciable percentage of cases, cannot be hurriedly made, unless 100 percent of a large series of cases show no improvement. When a certain number of cases do show evidence of improvement, it is important to determine whether that improvement is actual, or whether it is only within the limits of normal variation.

If improvement seems to be actual, then the true test of the value of that therapy is its ability either to maintain that improvement for an appreciable period of time, or to restore it, in case of regression, by additional administration of the therapeutic agent. Since the injections of cod-liver oil have resulted in some improvements, any preliminary report would be premature until the other qualifications—is improvement actual, can it be maintained or restored—have been more fully studied.

Until such time as its merit has been more fully determined, it would be sing-

ularly unfortunate if large numbers of ophthalmologists rush into action with this therapy and attempt to evaluate it on very small numbers of patients.

Filatov has not claimed any cure for retinitis pigmentosa. His claims for improvement run as high as 100 percent in one series (Table 1) and are certainly impressive, if they can be substantiated. In analyzing some of his case reports, it would appear that some of his "improvements" tend to fall more properly under the category of normal variations. Other results, however, are of such magnitude as to be considered as improvements.

CONCLUSION

A review of the various therapeutic attempts in retinitis pigmentosa has been presented, with especial attention to the details and claimed results of the Filatov method of tissue therapy. No attempt has been made to include a preliminary report of the work with this method, now being carried on at the New York Hospital. However, an attempt has been made to guide the investigator in this method, on the basis of observations made during the work at this Hospital.

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PERIPHERAL VISUAL ACUITY*

WITH SPECIAL REFERENCE TO SCOTOPIC ILLUMINATION

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The capacity of the retina to discriminate form decreases rapidly just outside the fovea and continues to diminish peripherally. Wertheim's classical data¹ show a steep drop in relative visual acuity from 1.00 at the fovea to 0.46 at 5 degrees, and then a slower drop to 0.20 at 10 degrees. An acuity of 0.20 could still be measured at 20 degrees. Ludvigh's measurements² roughly parallel these, the decline being even more precipitous in the paracentral region. Only 0.26 of the central acuity remained at 5 degrees, and 0.15 at 15 degrees. His data showed a relationship between peripheral visual acuity and the population of cone cells in the retina as given by Østerberg.³ The near parafoveal region was studied intensively by Weymouth and others,⁴ who showed that acuity falls off immediately and continuously from the foveal fixation point.

All these investigations were performed at high levels of illumination in order to demonstrate maximum acuity (Ludvigh used 26 to 36 foot-candles; Weymouth 18 millilamberts). No study of peripheral acuity under scotopic levels of illumination could be found. However, scotopic acuity measurements are of particular importance, because it is precisely under scotopic illumination that the peripheral

retina is called upon to take over the discriminatory functions. Only in the pathologic eye with a central scotoma is eccentric photopic acuity of prime importance; eccentric scotopic acuity is of importance in all eyes. It is quite plausible that with high illumination, peripheral acuity should parallel the cone population, as was pointed out by Ludvigh. Would scotopic measurements indicate a similar parallelism with the rod population? The rod population has its maximum density close to 20 degrees peripherally;³ the sensitivity of the retina to light is also greatest in this region.⁵ However, there were several reasons to believe that peripheral scotopic acuity need not follow this pattern. In the first place, if night-blind subjects are excluded, there is little correlation between light sensitivity and scotopic form discrimination.⁶ Furthermore, it has been the experience of many subjects familiar with various methods of testing scotopic form discrimination, such as were employed by the Army Air Forces, that fixation at an angle much smaller than 20 degrees gives maximum acuity in these tests. Finally, there is the theoretic reason that the maximum in light sensitivity attained at about 20 degrees is caused in part by a maximum summation of impulses from the individual rod cells, many cells in this region being connected synaptically with a single nerve fiber. This anatomic adaptation, providing maximum light sensitivity, does so at the expense of form discrimination, since the participating units in the retinal mosaic are very much larger.

* The measurements reported in this communication were performed at the Army Air Forces School of Aviation Medicine, Randolph Field, Texas.

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METHOD

A Clason Acuity Meter was used to project the visual acuity pattern on the center of a white screen in a darkened room. The form used was the Landoldt ring. Slides were constructed, each providing presentations of the ring with the break in the up, down, right, and left positions. Three slides were used, with rings 2, 6, and 12 mm. in diameter. With these slides and the continuously variable magnification the instrument provided, the diameter of the projected image could be varied from 12.5 to 245 mm.

The intensity of the projected light beam (the acuity pattern was black on white) was varied by means of neutral filters in steps of 1 log unit (10-percent transmission) and an iris diaphragm calibrated in steps of 0.3 log unit (50-percent transmission). The highest light intensity used was 9.0 log micromicrolamberts (approximately 1 millilambert). This intensity, although not sufficiently high to give maximum photopic acuity, is nevertheless well up in the photopic range, and sufficiently high to offer a basis for comparison with the lower scotopic levels in which we were primarily interested. The lowest intensity at which measurements were made was 4.3 log micromicrolamberts (0.00002 millilamberts).

The direction of fixation was controlled by means of a movable red fixation light. A 7-watt incandescent lamp, enclosed in a small housing, illuminated a 1-cm. circular aperture which was covered with a red filter and a neutral filter of density 2.0. The light in its housing was suspended behind the screen so as to illuminate one of a series of 3-mm. circular holes in the screen. The holes, with the exception of the one in use as a fixation point, were covered with white cardboard discs so as not to interfere with the projected pattern. When the desired fixation distances were greater than 35 cm.

(the screen was 70-cm. wide, and fixation distances were computed from its center); the fixation light was merely suspended at the desired distance off the screen.

Most of the measurements were made in the horizontal meridian. In order to facilitate the maintenance of correct peripheral fixation, the Landoldt ring was flashed on the screen for exposures of $\frac{1}{5}$ second. The short exposure, achieved by the introduction of a photographic shutter in the illumination system, insured that the subject did not move his fixation while he was making an observation. The success of this method was attested to by the fact that the after image of the projected light always bore the correct relationship to the fixation light.

Measurements of acuity were made at the fovea and peripherally as far as 30 degrees. It was found that accurate foveal measurements could not be made with the brief $\frac{1}{5}$ -second exposure, for it was never possible to be certain that an actual foveal measurement had been made. In the paracentral regions it is unimportant if a small error is made in the exact fixation angle recorded. However, even the slightest error is of significance in a supposedly central measurement. For the central measurements, therefore, the exposure of the test object was not limited; hence, the data for central measurements are not directly comparable with the paracentral measurements. An attempt was made to estimate the error introduced by not limiting the central measurements to $\frac{1}{5}$ second. It was found that at the highest brightness central acuity increased from 0.75 to 1.13 when the exposure time was increased from $\frac{1}{5}$ second to several seconds. In the paracentral areas, the difference was less marked. In peripheral areas, such as 20 degrees from the fovea, no increase at all was obtained; on the contrary, longer exposures caused the image to blur and disappear.

An experimental run consisted of visual-acuity measurements at a single retinal location for the entire range of illuminations. The highest intensity was employed first ($9.0 \log \mu\text{l}$), and then successively lower intensities down to the lowest ($4.3 \log \mu\text{l}$). Each run required approximately 45 minutes. During this time the eye of the observer became adapted to the progressively lower intensities to which it was exposed. The minimum visual angle at which 75 percent of the presentations were properly identified determined the visual acuity. Observations were made chiefly at a distance of 4 meters from the screen. For the higher intensity levels, for readings at or near the fovea, it was necessary to increase this distance to 8 or 10 meters in order to provide sufficiently small visual angles. In order to measure acuities lower than 0.022, the distance was diminished to 2 meters.

RESULTS

The right eye of one trained observer was studied intensively, and several measurements were made on the eyes of 18 other observers. Because of the great range in light sensitivity found in a normal group (1 log unit, a factor of 10), acuity measurements for different observers might not be comparable, and it was necessary to consider the entire range of data for all intensity levels and retinal locations of each subject as a unit.

The visual acuity for subject L. L. S., measured in the horizontal meridian from the fovea to 30 degrees peripherally at 17 brightness levels, is given in Table 1. More measurements were made for the temporal retina than the nasal retina because of the occurrence of the blind spot on the nasal side. The data are all average figures for two or three runs. Visual acuity is expressed in the decimal system instead of the commonly used acuity fractions. For comparison with the usual

20/20 or 6/6 notations, the decimal notation is merely the decimal conversion of these fractions.

Measurements of visual acuity less than 0.011 were not recorded, because the visual angle, and consequently the size of the retinal image, would be so large as to render such data meaningless in terms of a regional plot of visual acuity. A retinal area 1 degree in diameter is required to record a visual acuity of 0.083, and the error in retinal localization for this acuity may be considered to be 0.5 degrees. Similarly, if the acuity were as low as 0.0083, the retinal area concerned would be 10 degrees in diameter and the error 5 degrees.

For central fixation, acuity measurements could be made down to intensity levels as low as $5.6 \log \mu\text{l}$ (0.0004 ml.). Below this intensity, the center of the projected beam containing the image of the Landolt ring faded out. However, at $6.3 \log \mu\text{l}$ (0.002 ml.) the visual angle exceeded 1 degree, and the significance of measurements in this range as denoting central acuity is questionable. The data pertaining to this questionable range are enclosed in parentheses in Table 1. For determinations out to 4 degrees those involving visual angles greater than 2 degrees, and with implicit errors, therefore, of 1 degree in retinal localization, are also enclosed in parentheses. At 2 degrees, eccentric fixation acuity measurements could be made at intensity levels as low as $5.0 \log \mu\text{l}$; at 4 degrees, it was possible to make measurements as low as $4.3 \log \mu\text{l}$.

Retinal acuity contours are shown in Figure 1, where the curves for five light intensities are plotted. Only the data for the temporal half of the retina are shown; the nasal half showed fairly similar data, as can be seen in Table 1, with the exception that the apparent peak in scotopic acuity occurring at 4 degrees eccentric

fixation was not present. For the highest intensity level, the shape of the curve is quite similar to the previously recorded measurements of peripheral visual acuity. This is to be expected, since our highest $\mu\mu\text{l}$, paracentral acuity exceeds foveal acuity. The acuity peak occurring at 4 degrees in the temporal retina persists throughout the intensity range from 7.6 to 4.9 log $\mu\mu\text{l}$. In this range, therefore, it

TABLE 1
VISUAL ACUITY FOR ECCENTRIC FIXATIONS ALONG THE HORIZONTAL MERIDIAN

A. Temporal Retina													
Light- Int. Log $\mu\mu\text{l}$	Central	$\frac{1}{2}^\circ$	1°	2°	3°	4°	5°	7.5°	10°	15°	20°	25°	30°
9.0	1.13	.75	.63	.53	.38	.35	.31	.26	.11	.083	.058	.044	.032
8.7	1.13	.68	.63	.53	.35	.33	.27	.26	.11	.083	.058	.044	.032
8.4	1.12	.68	.63	.53	.34	.30	.25	.23	.11	.083	.058	.044	.032
8.1	.88	.68	.54	.53	.32	.30	.18	.21	.10	.083	.058	.044	.032
7.9			.50	.42	.28	.26	.18	.16	.10	.083	.058	.044	.032
7.6	.65	.49	.38	.27	.20	.25	.18	.13	.10	.083	.058	.044	.032
7.3	.52	.31	.27	.22	.18	.22	.16	.11	.10	.077	.058	.044	.032
7.0	.32	.25	.20	.15	.12	.17	.13	.11	.083	.077	.058	.044	.032
6.6	.21	.12	.11	.10	.11	.15	.12	.10	.083	.061	.058	.042	.032
6.3	(.08)		(.045)	(.074)	(.066)	.12	.088	.088	.066	.050	.047		.032
6.0	(.07)		(.030)	(.046)	(.039)	.10	(.066)	.066	.050	.041	.042	.036	.030
5.6	(.028)		(.022)	(.037)	(.025)	(.063)	(.052)	.065	.050	.037	.039		.028
5.3				(.022)	(.023)	(.059)	(.047)	.053	.044	.030	.033	.033	.026
5.0				(.015)	(.021)	(.038)	(.028)	.033	.035	.026	.024		.020
4.9					(.015)	(.031)	(.025)	.023	.028	.024	.024	.024	.020
4.6						(.024)	(.014)	.023	.023	.024	.020	.016	.015
4.3						(.011)		.020	.014	.016	.016	.011	.011

B. Nasal Retina													
9.0				.42		.26	.22		.11				.020
8.7				.42		.26	.22		.11				.020
8.4				.42		.26	.19		.11				.020
8.1				.42		.26	.19		.11				.020
7.9				.31		.18	.15		.11				.020
7.6				.27		.15	.12		.11				.020
7.3				.22		.14	.10		.094				.020
7.0				.18		.12	(.077)		.062				.020
6.6				.13		.093	(.066)		.057				.020
6.3				(.083)		(.077)	(.055)		.057				.020
6.0				(.056)		(.056)	(.050)		.045				.017
5.6				(.022)		(.035)	(.037)		.045				.017
5.3						(.029)	(.028)		.045				.017
5.0						(.022)	(.023)		.029				.017
4.9						(.020)			.025				.017
4.6						(.011)			.020				.014
4.3									.011				.014

Note: For all eccentric fixations along the horizontal meridian, the exposure time was one-fifth second; for central measurements, the exposure was of several seconds' duration.

intensity level was in the photopic range. At lower illuminations the central peak is not as precipitous, central acuity decreasing more rapidly than paracentral or peripheral acuity with diminution in light intensity. At intensity levels below 6.3 log would appear that fixation 4-degrees temporally to the object viewed affords maximum acuity. (In taking the Eastman Night-Vision Test and other tests involving scotopic form discrimination this subject had found that approximately this

fixation gave the best results.) At the lowest intensity levels, it can be seen that the contour is quite flat, visual acuity being almost constant from 4 degrees to 30 degrees.

Curves showing the relationship between visual acuity and light intensity for various areas in the temporal retina are shown in Figure 2. In order better to show the shapes of the curves, visual acuity as well as light intensity is plotted logarithmically. In order to avoid negative logarithmic designations, all acuity data are multiplied by 100 in this figure.

With central fixation and with eccentric fixations out to 30 degrees, the curves rise fairly steadily with increasing illumination, leveling off well in the photopic range. The maximum acuities diminish as the degree of eccentric fixation is increased. At 5 degrees a new phenomenon is quite evident: a distinct break occurs in the curve, indicating a division into a rod curve at the lower intensities and a cone curve at the higher intensities. A suggestion of this division into two component curves is seen at 4 degrees; the break is clearly evident at 7.5, 10, 15, and 20 degrees. It may be assumed, therefore, that sufficient rod cells are present in the retina at 4 and 5 degrees to dominate discriminatory function at intensity levels up to $8.0 \log \mu\text{l}$ (0.1 ml.), the intensity level at which the break occurs in the 4- and 5-degree curves.

Since, with central fixation, the test object was not discernible at intensity levels below $5.6 \log \mu\text{l}$, this intensity may be taken as the foveal light threshold. The light thresholds of the paracentral and peripheral cones vary only slightly from the central threshold. It is evident, therefore, that there is a wide range, up to $8.0 \log \mu\text{l}$, where the rod cells dominate the acuity process at 4 and 5 degrees eccentric fixation, despite the fact that cone cells

must be functioning. The reason for this is that the rod cells are functioning at their maximum efficiency at illuminations which are quite high for rod cells. The cone cells, on the other hand, are func-

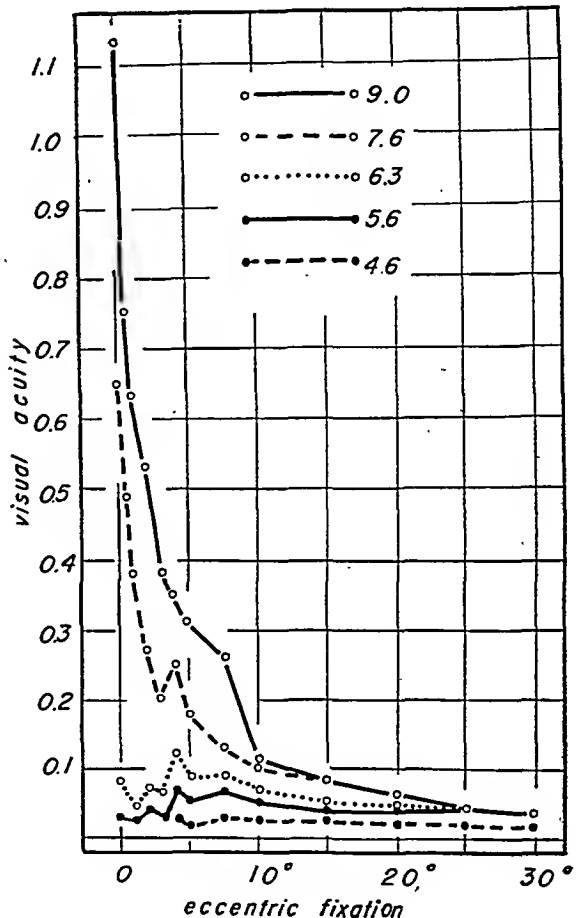


Fig. 1 (Mandelbaum and Sloan). Visual acuity measured along the horizontal meridian of the temporal retina at five intensity levels ranging from 4.6 to 9.0 log micromicrolamberts. All eccentric measurements were made with $\frac{1}{2}$ second exposures; the central measurements were made with exposures of several seconds' duration. At 25 and 30 degrees all the curves except for 4.6 log micromicrolamberts practically run together, and are designated by single points.

tioning inefficiently at what is for them very poor illumination.

That there is such an overlap between cone and rod function, rather than an intensity level at which the rods cease to function and the cones begin to function,

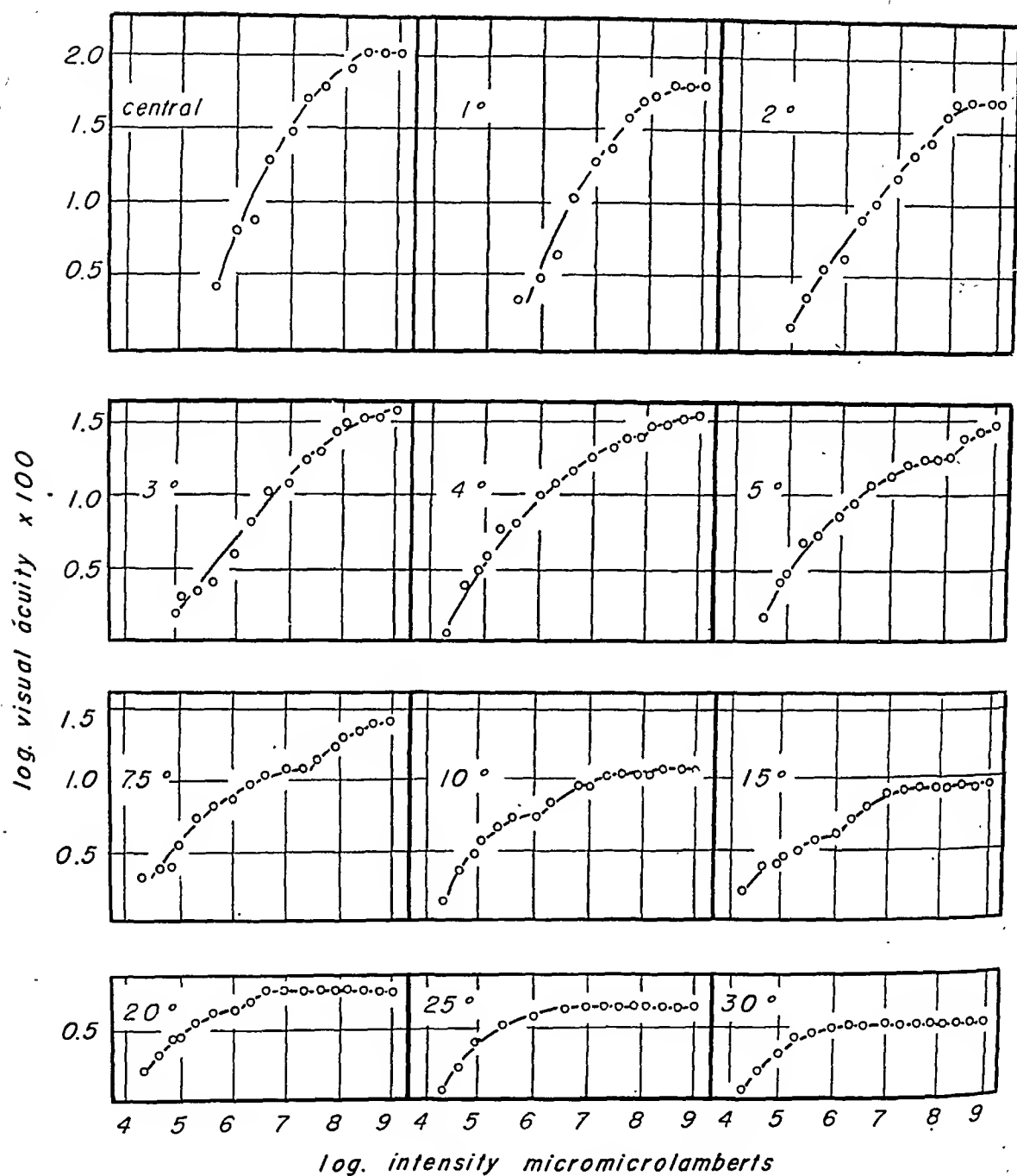


Fig. 2 (Mandelbaum and Sloan). Visual acuity curves for various locations in the temporal retina along the horizontal meridian. Visual acuity as well as light intensity is plotted logarithmically.

is to be expected from physiologic considerations, and can easily be demonstrated by other means. One of the easiest methods to demonstrate this is by viewing a spectral violet light after exposing one eye to a bright light while the other is

kept dark adapted.⁷ The intensity of the violet light should be approximately 1 millilambert. To the light-adapted eye, it will appear as a rich saturated color. The dark-adapted eye, however, will perceive a very pale, unsaturated color, because

here the cone sensation is diluted by the whiteness of rod sensation.

For 7.5-degrees eccentric fixation, the scotopic process dominates only to the intensity level $7.5 \log \mu\text{l}$; for 10, 15, and 20 degrees, the break is at approximately 6.0. This shift to lower intensity levels for the break between scotopic and photopic function, demonstrated in the curves as the eccentricity of fixation is increased, is probably related to the diminution in the resolving power of the more peripheral rods. The maximum acuity of the rod component of the curve for 4 degrees eccentric fixation, occurring at the intensity level $7.9 \log \mu\text{l}$, is 0.26 (as given in Table 1). For 5 degrees, it is 0.18; for 7.5 degrees, 0.11; at 20 degrees it is only 0.042, occurring at the intensity level 6.0 $\log \mu\text{l}$. Because of this progressive diminution in rod resolving power, the cone cells take over the discriminatory function at lower intensity levels, closer to the cone light threshold.

As the fixation becomes more peripheral, the cone curve becomes less prominent. At 10 degrees the increase in visual acuity mediated by the cones appears to be from 0.050, the peak achieved by rod function, to 0.11. At 20 degrees, the increase is only from 0.042 to 0.058. At 25 and 30 degrees eccentric fixation, no cone curve at all can be made out, and only the rod curve remains. The contribution of the cone cells in this region to visual acuity seems to be of such poor order that they fail to exceed the efficiency of the rod cells, even at high levels of illumination.

It is evident from both Figure 1 and Figure 2 that the significance of illumination as a limiting factor in visual acuity diminishes considerably from the center to the periphery of the retina. When fixation is only 1-degree eccentric, visual acuity increases from 0.022 to 0.63 as the

light intensity is increased from 5.6 to 9.0 $\log \mu\text{l}$. At 10 degrees the increase is only from 0.014 to 0.11 as the intensity is increased from 4.3 to 9.0, while at 30 degrees for a similar increase in intensity, acuity increases from 0.011 to 0.032.

Because of limitations in time, it was not possible to repeat these extensive measurements on more than one subject. Sufficient measurements were made on the eye of one other subject (J. M.) to confirm the general trend of the data given by L. L. S. In addition, binocular measurements were made on 18 subjects at an intensity level of $5.8 \log \mu\text{l}$, where the scotopic process dominates the picture. Maximum peripheral acuity for these subjects at the fixed intensity level was found to vary from 0.11 to 0.50, and occurred at retinal locations ranging from 4- to 8-degrees eccentric. Most of the subjects gave higher acuity readings when the fixation point was to the right of the test object; whether this has to do with the apparent superiority of the temporal retina and right-sided ocular dominance could not be determined. In three subjects vertical fixations were compared with horizontal ones; equally eccentric horizontal fixations gave approximately 10 percent better visual acuity.

CONCLUSIONS

1. Scotopic peripheral acuity does not parallel the rod population or the light sensitivity of the retina.

2. Maximum scotopic acuity can be achieved by 4- to 8-degrees eccentric fixation.

3. Light intensity is not as critical a factor in peripheral acuity as it is in central acuity.

4. At the lowest scotopic levels, visual acuity is fairly constant from 4-degrees to 30-degrees eccentric fixation.

5. A considerable overlap occurs between cone and rod function, the para-central rods dominating discriminatory function at light intensities well above the cone light threshold.

6. For 25- and 30-degrees eccentric

fixation, the rod cells dominate form discrimination even at intensity levels as high as 1 millilambert.

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THE EFFECT OF ELECTRIC STIMULATION ON OCULAR TENSION*

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The investigations of Prof. S. V. Kravkov and L. P. Galochkina demonstrated that the action of a weak galvanic current on the eye produces various changes in light and color perception. In view of these findings it seemed interesting to determine if stimulation with the galvanic current has any effect on ocular tension—a function which can be studied objectively. There were no data on this subject in the available literature.

Our method of investigation was as follows: The test person was adapted for 20 to 30 minutes to the usual daylight illumination of the laboratory. Tension was taken with the Schiøtz tonometer, after one instillation of 1-percent dicaine into the conjunctival sac. Then a galvanic current of 0.5 ma. was applied to the eye for 10 minutes. We used silver electrodes, wrapped in cotton moistened in physiologic saline solution. The positive electrode was applied at the temple close to the external canthus. The negative electrode was held in the opposite hand. Tension readings were taken at intervals of 4 to 5 minutes during galvanization. After the current was turned off, tension was recorded every 10 minutes for one hour. The test was performed in light adaptation and lasted about 90 minutes. The current was obtained from an accumulator, its intensity regulated by a rheostat and measured by a galvanometer. The tests were performed on six persons (mostly students).

Fundus and vision examination of these persons showed no deviation from nor-

mal with the exception of one case, which showed slight myopia. Altogether the following results are based on about 40 tests.

RESULTS

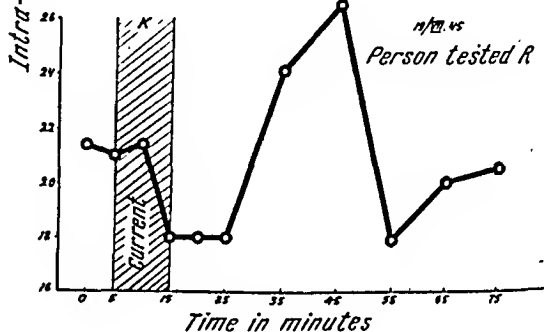
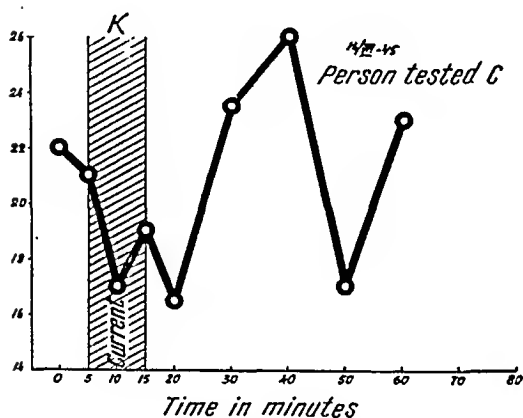
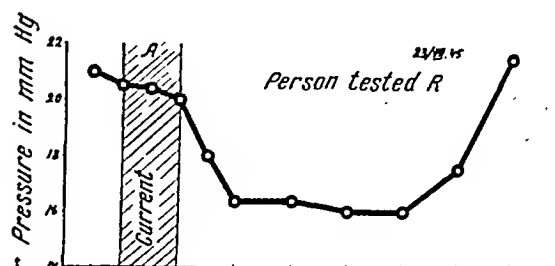
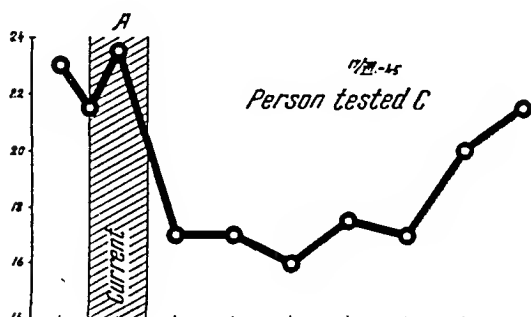
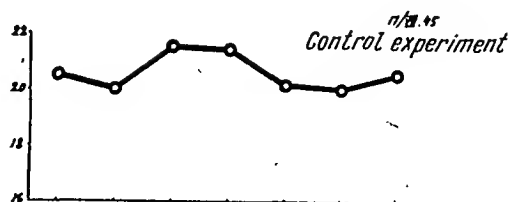
The results showed that galvanic stimulation in the intensity used produced noticeable changes in ocular tension. The changes were different, depending on whether the anode or the cathode was applied to the eye. Application of the anode to the eye invariably produced a reduction in tension from that found at the beginning of the test. There was no such constancy when the cathode was applied. In fact, in a number of cases hypertension was produced. Typical findings are illustrated in Figures 1 and 2. These graphs show the changes in tension recorded on different days for the same test person.

As may be seen from these charts, the tension curves are different after cathodic and anodal galvanization. The fluctuation in tension was more varied at the cathode (not infrequently varying 9 to 10 mm.) than at the anode. Reduction of tension at the anode was noticed in all curves. (In some cases the effect of the cathode was not so definite). Control tests were made, with the same set-up, but without galvanization of the eye. As may be seen from the curves no permanent changes in the tension were seen.

DISCUSSION

What are the processes leading to the changes in ocular tension herein described that are stimulated in the eye by action of the electric current? The mechanism of action of the galvanic current (cathelectrotonus and anelectrotonus) on the ocular tension is as yet not clear. It is pos-

* From the Laboratory of Physiologic Optics of the Helmholtz Central Institute of Ophthalmology. Director of the Laboratory, Prof. S. V. Kravkov. Director of the Institute, Prof. A. A. Kolen. Read at a scientific meeting of the Institute, July, 1945.



Figs. 1 and 2 (Zaretskaya). The influence of a constant current on intraocular pressure. These graphs show the changes in ocular tension recorded on different days for the same test person. The lined column represents the time of galvanization on one day with the cathode, and on another day with the anode. A, identifies the test with the anode to the eyes. K, with the cathode.

sible that its effect on tension can be attributed to changes in the potassium-calcium balance.* These changes, according to the literature, take place during electrization of living tissue and may lead to profound changes in the metabolism of the cell.

It is interesting to mention in connection with our data Zondek's work, which shows that the physiologic action of po-

tassium is similar in effect to stimulation of the parasympathetic vagus nerve and that of calcium simulates the stimulation of the sympathetic.

Further investigation in this field may reveal that the reaction of intraocular pressure to electric stimulation may have diagnostic and, perhaps, therapeutic significance. Investigations on the effect of galvanism on intraocular pressure and on the pathogenesis of these phenomena will continue.

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OCULAR MANIFESTATIONS OF MUMPS

A CASE OF MUMPS KERATITIS

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According to Parran,¹ mumps ranked next to venereal diseases as the most disabling of the acute infections among recruits of World War II. It is essentially a childhood disease. When present in young adults, the manifestations are much more serious. It has been estimated that in World War I, about four million man hours were lost by military personnel because of mumps. Statistics are not yet available on the manifestations and disability produced by mumps in this war.

In 1934,² the infectious agent of mumps was found to be a filterable virus. By injecting the saliva from patients in the early stages of the disease into Stenson's duct of monkeys, Johnson and Goodpasture were able to reproduce the disease. They were then able to reproduce the disease in human children by spraying the buccal mucosa and instilling into the nostrils the virus taken from the parotid glands of the monkeys.

The portal of entry of the mumps virus seems to be the nose and mouth,³ although Philibert⁴ believes that the portal of entry is possibly the conjunctiva with lodgement of the virus in the brain. When the virus is of low virulence, a slight and transient secondary reaction of the meninges occurs. When the virus is more active, clinical encephalitis is produced. He states that the virus is finally eliminated by the salivary glands.

Apparently the virus is transmitted by droplet infection upon direct contact. The incubation period is about 18 days, the disease becoming communicable about 24 hours before the onset of the first symptoms. One attack usually produces lifelong immunity. Both sexes are affected

equally. Mumps is endemic and can occur at any time, but the incidence is usually increased during the winter and spring. Mumps is now considered a systemic disease, probably a generalized infection of the blood stream through which the virus travels to reach the involved organs. No method of producing active immunity exists other than by acquiring the disease in its natural form.⁵ The varieties of extra-parotid manifestations may precede, accompany, or follow the onset of the parotitis.

Enders⁶ was interested in establishing a test for susceptibility so that in the event of an outbreak of mumps, a large number of nonsusceptible contacts would not have to be quarantined. He found antibodies in 92 percent of the sera of those giving a positive history of mumps, and in 50 percent of those giving a negative history. He concluded that one half of those giving a negative history may have had a silent infection at one time or another. Because the complement-fixation test was too laborious, that author sought another test to determine immunity and injected a diluted heat-inactivated suspension of infected parotid glands of monkeys intradermally. In nearly 100 percent of those giving a positive history of mumps, an erythematous reaction occurred after 24 to 48 hours at the site of injection. Enders concludes from the results obtained that a positive skin reaction indicates a previous infection with the virus; whereas, failure to react signifies, in most instances, potential susceptibility.

The council on Pharmacy and Chemistry,⁷ in its preliminary report, stated that human, convalescent, mumps serum

seems to be of therapeutic value in the hands of some investigators and induces some degree of passive immunity. Other investigators found the results less certain.

The recent work of Stokes⁸ and his co-workers on the use of formol-inactivated suspension of mumps virus as a vaccine against mumps is encouraging.

The manifestations of mumps in order of their frequency are: orchitis, oophoritis, pancreatitis, mastitis, and dacryoadenitis. Other less frequent manifestations are thyroiditis, bartholinitis, prostatitis, meningitis, encephalitis, and neuritis of the cranial nerves. The ocular manifestations are dacryoadenitis, conjunctivitis, scleritis, uveitis, keratitis, optic neuritis, retinitis, and ocular palsies.

OCULAR MANIFESTATIONS OF MUMPS

With our present knowledge of the pathogenesis of mumps, it is safe to assume that ocular manifestations may occur without any other signs or symptoms; therefore, a description of some of the more common ocular manifestations would not be out of place. Most textbooks on ophthalmology fail to mention all the manifestations of mumps. When they are mentioned, there is very little description of the clinical manifestations.

Villard⁹ believes that dacryoadenitis is the most common ocular manifestation of mumps. It is almost always bilateral, non-suppurative, and appears suddenly with sharp pains in the entire area of both orbits, radiating to the temples and forehead. Edema, especially in the external portions of the upper eyelids, and redness occur almost simultaneously with the onset of the pain. There is marked chemosis of the bulbar conjunctiva which usually herniates between the eyelids. The cornea is uninvolved. Palpation reveals a cartilaginouslike mass, generally elastic,

and painful in the region of the lacrimal glands. After several hours the symptoms begin to abate, with complete resolution of the inflammation of the glands in from several days to several weeks. Warm compresses is the only therapy advocated.

In the absence of any secretion, Villard states that mumps conjunctivitis is really a mild form of dacryoadenitis, involving the glandular acini present in the conjunctiva. Sendral¹⁰ reported a case of bilateral dacryoadenitis that preceded the onset of parotitis in a 10-year-old girl. This patient also developed mastitis and oophoritis. At first glance, a diagnosis of suppurative or gonorrheal conjunctivitis suggested itself until the lids were separated, and the absence of suppuration was noted.

There is no characteristic clinical picture of the iritis and iridocyclitis following mumps. All the cases reported cleared up without any sequelae, and were treated only locally with atropine.

Optic neuritis occurs in two forms; the retrobulbar type and neuroretinitis. In the retrobulbar type, complete recovery is the rule. In the neuroretinitic type, secondary optic atrophy may result. The retrobulbar type of neuritis is less common than the neuroretinitic type.

Young¹¹ reported a 10-year-old patient who showed optic neuritis with swelling of the nerve head 13 days after an attack of mumps. Vision dropped to nil following treatment with lactigen and mercurochrome, and then gradually returned to 6/6 (partly) in each eye. The visual fields were normal for a 10-mm., white test object. The nerve heads showed marked pallor.

Swab's¹² case of encephalitic optic neuritis resulted in postpapillitic atrophy of the nerve heads. Onset of the neuritis was 37 days after mumps for the right eye, and 46 days after mumps for the left eye.

Drainage of the spinal fluid was recommended as a therapeutic procedure by Hubbard. Powell and Dunlap¹³ reported two cases of optic neuritis with complete recovery. Case 1 occurred three weeks after the onset of the parotitis. There was questionable vision in each eye. Following the use of artificial-fever and foreign-protein therapy, vision in each eye returned to normal five months after the onset. The second patient who developed visual difficulties, one month after an attack of mumps, also had a paralysis of accommodation. The visual acuity, accommodation, and visual fields gradually improved to normal. These authors emphasize the necessity of investigating cases of visual disturbances following mumps.

Butler and Wilson¹⁴ observed two cases of ocular paralysis following mumps. The first patient was a nine-year-old boy with complete paralysis of accommodation following an attack of mumps three weeks earlier. Recovery was complete. The second patient was a 12-year-old boy who had mumps 30 days before the onset of a complete third-nerve paralysis of the left eye. Two days later the external rectus became paralyzed. The superior oblique did not become involved. Eight months later, internal ophthalmoplegia and paralysis of elevation were still present, along with a slight weakness of convergence and abduction.

KERATITIS DUE TO MUMPS

Keratitis due to mumps is exceedingly rare. Villard⁹ collected only three cases from the literature, two of which were ulcerative, healing with a central leukoma and producing a marked diminution of vision. The third case was an interstitial type of keratitis with complete recovery.

Danielson and Long¹⁵ were able to find

only seven cases of mumps keratitis in the entire literature, and added one case of their own. So uniform was the clinical appearance of the cases reported, that the authors considered mumps keratitis a definite clinical entity. The onset usually occurs with redness of the bulb and lacrimation from about 2 to 11 days after the onset of the parotitis. Pain is very slight or absent. Within a few days, a diffuse keratitis develops, producing a marked clouding of the cornea. Marked reduction of vision follows. The pupil reacts to light, and also dilates maximally with atropine. Uveitis or synechias have not been observed. Vascularization of the cornea is absent, and complete recovery with unimpaired vision occurs in from one to four weeks. All cases have been unilateral, either eye being involved. Lippmann¹⁶ added another case of mumps keratitis making a total of nine known cases. The rapid onset of the opacity, involving the entire cornea, which reaches a high degree of density with corresponding loss of vision and shows complete clearing without scar formation, has been stressed by him as differential diagnostic signs.

To help establish mumps keratitis as a definite clinical entity, I wish to report a 10th case.

CASE REPORT

HISTORY

P. E. L., an aviation cadet, aged 26 years, was admitted to an army hospital on July 27, 1943, complaining of pain and swelling in both parotid regions of two days' duration associated with some malaise. On the day of admission, a burning sensation of the right eye and blurred vision were experienced. Examination by the ward surgeon revealed a conjunctival injection with some apparent cloudiness of the right cornea, and a bilateral, somewhat tender swelling of the parotid

glands. Two days after admission, I was called to see the patient, who then complained of some pain, photophobia, and lacrimation in the right eye associated with marked reduction of vision, all of two days' duration. Vision was limited to hand movements at two feet in the right eye, and was 20/20 in the left eye.

OCULAR EXAMINATION

Examination of the right eye revealed a two-plus, mixed injection of the bulbar conjunctiva. The cornea was uniformly hazy, giving it a milky appearance. It did not stain with fluorescein. With loupe magnification and oblique illumination, deep interlacing linear opacities could be made out. Descemet's membrane showed some folds. The anterior chamber and iris appeared normal. The pupil did not appear irregular nor did it differ in size or reaction to light from its fellow.

Further ocular examination was accomplished at the eye clinic to which the patient was brought after proper facial draping to prevent the spread of the mumps. Slitlamp examination revealed normal surface epithelium. The linear opacities were localized in the substantia propria, most numerous in the posterior one third. Definite wrinkling of Descemet's was present. There were no keratic precipitates. Vascularization, either superficial or deep, was absent. Fundus details could not be made out. The left eye was entirely normal. The diagnosis was acute keratitis complicating epidemic parotitis. Hot compresses were applied, and a 1-percent atropine solution was instilled 3 times daily. The pupil dilated readily with atropine. It was noted that the dilatation was maximal and that the pupil was uniformly round.

COURSE OF THE DISEASE

The next day, July 30th, the cornea was still diffusely hazy, but there was definite clearing at the periphery. There was no change in the intensity of the bulbar injection. The pupil was widely dilated. The same treatment was continued. Inspection of the right eye 24 hours later showed marked improvement, the opacity being now limited only to the central portion of the cornea. The injection of the bulb had also decreased. Because of the rapid clearing of the corneal opacity, the use of intravenous typhoid was withheld. Clearing of the remainder of the cornea continued steadily. On August 5th, nine days after the onset, the eyeball appeared perfectly white; the cornea was entirely transparent and was essentially negative to slitlamp examination. Vision was 20/20. Further medication was discontinued. The patient was discharged back to duty on August 10th, at which time another ocular examination was made on the right eye. All findings were normal.

CONCLUSION

Mumps is now considered to be a systemic virus disease which affects the various organs through the blood stream. The ocular, as well as some of the systemic, manifestations may precede, follow, or accompany the onset of the parotitis.

Keratitis, the rarest of all ocular manifestations of mumps, is a definite clinical entity as established by the similarity in the onset, clinical appearance, and course of the nine cases previously reported, and the one just added by me. The term, Mumps Keratitis, is advocated.

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PRIMARY GLAUCOMA AND THE PITUITARY-DIENCEPHALIC SYSTEM*

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It is a well-known fact that in many respects knowledge of the pathogenesis of primary glaucoma is still vague. Among other causes, endocrine factors are believed to be responsible for its occurrence—thyroid,¹ pituitary,² cortico-adrenal system,³ and gonads.⁴ In recent years we have had the opportunity of examining 22 cases of primary glaucoma which were referred to us for internal examination with the view that there might be a possible connection between the ocular condition in these cases and the diencephalon or pituitary-diencephalic system. Such a relationship has already been established between other ocular diseases and the pituitary body or the diencephalic-pituitary system (retinitis pigmentosa, Zondek and Koehler⁵ and Zondek and Wolfsohn;⁶ the Lawrence-Moon-Biedl syndrome; and pituitary-diencephalic exophthalmos, L. P. Daniels,⁷ Zondek and Ticho⁸). We made tests of the carbohydrate and water metabolism, basal metabolism, blood cholesterol, and the osseous structure of the skull. A few characteristic cases will be reported in brief.

CASE REPORTS

Case 1: C. S., aged 15 years, gave the history that his mother was suffering from primary glaucoma (case 2). Although he had just been seen by an oculist who found increased ocular tension, the patient made no complaints. He was very tall—just over six feet—with a moonlike face. Pubic and axillary hair growths were normal. There was no facial hair growth. Visceral organs were nor-

mal. Blood pressure was 95/70 mm. Hg.

Laboratory findings showed: blood count and urinalysis, negative. Glucose-tolerance test at half-hour intervals showed: 122, 118, 100, 107, 90, and 114 mg. percent (hyperinsulinic curve). Volhard test: after having drunk 1,000 cc. water, the patient voided 800 cc. urine within the next two hours. X-ray studies showed the sella turcica to be normal; the skull to be extremely rarefied, and the galea to have an appearance almost like cotton wool; thus, giving an impression of the beginning stages of Paget's disease of the bone. The eyes showed primary glaucoma.

Case 2. Mrs. E. S., aged 39 years, was the mother of the boy in Case 1. She had had a rather large goiter since childhood. For the past few years, the patient had seen rings in front of her eyes. Her voice was said to have grown hoarse and deep lately. She had a tendency toward pronounced oscillations in weight; for example, gain in weight had been 17 to 18 pounds in the last month. She was subject to moods of depression accompanied by voracious hunger and feelings of anxiety. She was masculine in type and showed hirsutism. She had a rather large parenchymatous goiter.

Examination on admission to the hospital showed the visceral organs to be normal. Blood pressure was 110/70 mm. Hg. Urinalysis and blood count were normal. Glucose-tolerance test at half-hour intervals showed: 80, 142, 117, 107, 96, and 75 mg. percent; glycosuria occurred at the time of the second and third readings. A second glucose-tolerance test at half-hour intervals gave this reading: 80, 117, 80, 62, 78, and 67 mg. percent; gly-

* From the Department of Internal Medicine, Bicur Cholim Hospital.

cosuria occurred at the time of the second, third, and fourth readings (traces, 1 percent, and traces). The sella turcica was widened in the anterior-posterior diameter. There were vascular furrows in the skull. Blood cholesterol showed 266 mg. percent. The basal-metabolism rate was a minus five. The eyes showed primary glaucoma.

Case 3. Mrs. S. L., aged 42 years, in giving the family history said that three brothers and three sisters out of nine siblings were suffering from glaucoma. She had had four operations for glaucoma, one on the right eye and three on the left eye. Glaucoma attacks occurred just before menstruation, which is regular. She had always been fat, and during the past months had been gaining. She suffered from migrainelike headaches.

On admission to the hospital, her weight was 191.4 lbs. She had a moon-like face. Striae were not present. The pulse rate was 60. Blood pressure was 120/80 mm. Hg. The visceral organs were normal. Urinalysis and blood count were normal. The glucose-tolerance test was: 68, 129, 120, 118, 169, and 230 mg. percent; no glycosuria. The Volhard test was normal. Basal-metabolism rate was a plus 29. Ten days after menstruation there were 500 mu of estrone in the urine. The sella turcica was of normal size and shape. There were increased vascular furrows in the skull. The ocular findings showed primary glaucoma.

Case 4. Mrs. L. R. had suffered from migraine since childhood. Menstruation was somewhat irregular, and she had always been moderately fat.

Examination on admission to the hospital showed moderate obesity. The visceral organs were normal. Blood pressure measured 125/70 mm. Hg. Urinalysis and blood count were normal. Readings at half-hour intervals in the glucose-tolerance test were: 117, 145, 121, 138, 110,

and 163 mg. percent (diabetic type); no glycosuria. Two blood-cholesterol readings were: 350 mg. percent and 266 mg. percent. The Volhard test showed: after drinking 1,000 cc. of water, the patient eliminated 1,220 cc. of urine within the following two hours. The basal-metabolism rate was a plus two. X-ray studies of the skull showed the posterior clinoid processes to be poorly defined. There were increased vascular furrows in the skull and extreme rarefaction of the osseous structure. The eyes showed primary glaucoma.

Case 5. Miss E. N., aged 30 years, had a negative family history. For several years, there had been a progressive enlargement of the prominent parts of the patient's body—nose, lips, tongue, hands, feet, and so forth. She had been suffering from an increasing number of headaches. Menstruation had become irregular and then had ceased entirely about a year earlier. About three years before, the patient had had X-ray irradiation of the pituitary gland. A few months after this, her vision became worse and she complained of green rings in front of her eyes. She was treated with pilocarpine and eserine. She is subject to moods of depression.

Upon admission to the hospital, she showed obesity. Her face was puffy and had a bluish-red tint. Her lips were thickened, and her tongue, feet, and hands enlarged. Her voice was hoarse. The pulse rate was 60 to 72. Blood-pressure reading was 140/70 mm. Hg. With the exception of the heart, which was enlarged to the left and gave dull sounds, the visceral organs were normal. The tendon reflexes were sluggish.

Laboratory findings gave the following results. Blood count and urinalysis were normal. The glucose-tolerance-test readings were: 98, 110, 120, 134, 116, 134, and 134 mg. percent. Blood cholesterol showed

169 mg. percent. In the Volhard test, after the intake of 1,000 cc. of water, 320 cc. of urine were eliminated in the following four hours. The basal-metabolism rate was a plus 16. Electrocardiogram readings were normal. There was an enlarged sella turcica, unilaterally excavated; the galea was very thick; there were increased vascular furrows in the skull (pituitary tumor). The eyes showed primary glaucoma.

Case 6. Mrs. F. S., aged 62 years, gave a negative family history, and her previous history was irrelevant.

Examination upon admission to the hospital showed obesity. She had cyanotic lips. Her pulse rate was 106. The blood-pressure reading was 190/110 mm. Hg. The visceral organs were normal, the heart and aorta were not enlarged. Urinalysis and blood count were normal. Readings for the glucose-tolerance test were: 115, 181, 203, 206, 225, and 181 mg. percent; glycosuria was present at the time of the fourth, fifth, and sixth readings (1, 2, and 3.4 percent). The Volhard test was normal. Blood cholesterol was 308 mg. percent. The basal-metabolism rate was plus 18. An X-ray film of the skull showed a pituitary tumor which had penetrated into the sphenoid sinus. Ocular examination showed primary glaucoma in the right eye.

Case 7. Miss B. N., aged 45 years, said that her mother had glaucoma. The patient was first seen by us seven years ago. At that time, she said that menstruation had ceased about one year earlier. Her hands and feet had grown larger, and her face had coarsened. She complained of splitting headaches and was subject to moods of depression. Five years ago, X-ray irradiation of the pituitary gland caused the headaches to subside. After the lapse of a year, however, the patient began to see rings in front of her eyes. Following this symptom, a diagnosis of glaucoma was made. Since then she has

been under the constant care of oculists.

Examination at this time showed her to be of the acromegalic type. She had enlarged hands, feet, lips, and tongue; her arms and legs were bulky. With the exception of a slightly enlarged left ventricle of the heart, the visceral organs were normal. Blood pressure showed 120/80 mm. Hg. Apart from traces of albumin, the urinalysis was negative. Blood count was normal. Glucose-tolerance test showed: 111, 151, 118, 125, 129, 111, and 117 mg. percent. Blood cholesterol measured 262 mg. percent. In the Volhard test, after the intake of 500 cc. water, 80 cc. urine were voided within the following four hours. The basal-metabolism rate was a minus two. There was bone atrophy around the sella turcica, which was uniformly enlarged. There was marked vascular congestion. The eyes showed primary glaucoma.

DISCUSSION

Among the 22 cases of primary glaucoma studied, 16 cases gave various combinations of evidence which pointed to disturbances in the pituitary-diencephalic system. Obesity, menstrual troubles, disordered carbohydrate metabolism, a tendency toward water retention, deviations of the basal-metabolism rate from the normal average, decalcification or atrophy of the bony skull (particularly around the sella turcica), occasionally calcification also, congestion of the meningeal vessels, and a rise in blood cholesterol were among the signs noted.

It should be emphasized that abnormally high blood-cholesterol values were frequently found in processes localized in the pituitary-diencephalic region (Zondek and Ticho⁸).*

It is noteworthy, too, that pitui-

* The author has recently learned that Schmelzer also reported upon the rise in blood cholesterol in cases of primary glaucoma (Med. Welt, 1943, v. 44 and 45, p. 779).

tary tumors were present in 6 of these 16 cases, and that two of the patients with pituitary tumors presented the characteristics of acromegaly. In 6 cases out of our total number of 22 cases, there was no evidence of any pituitary-diencephalic disturbances. This fact may indicate that the pathogenesis of primary glaucoma cannot be viewed from a common aspect. On the other hand, it is impossible to ignore the findings established in the majority of our cases.

It would appear from previous investigations—at least in a number of cases of primary glaucoma—that two etiologic factors are of special importance:

1. Abnormal vascular function.
2. Hydration of the corpus-vitreum tissues.

In abnormal vascular function, both the abnormal narrowing (spasm and sclerosis) of the afferent vessels of Schlemm's canal (according to Friedenwald⁹ this delays the flow of blood through the canal and causes a decrease in water-reabsorption rate) and abnormal dilatation of the vessels (this causes an increase of vascular permeability and, therefore, an increase of intraocular fluid) play an important part.

It might be added that the lowering of intraocular pressure in diabetic coma, a condition known to be associated with dehydration, may be considered as a proof for the role played by the ocular fluid content in regulating ocular tension. Both abnormal circulation and the tendency toward tissue hydration may well be explained by disordered pituitary function. It is up to future research to demonstrate whether, and how, antidiuretic hormones can get into the eye.

In 1935, one of us (H. Z.¹⁰) reported upon a syndrome for which the term "diencephalopathy" was suggested. This syndrome not only comprises certain metabolic disturbances pointing to the diencephalon but also changes in the osseous

structure of the skull (either abnormal calcification or abnormal decalcification), psychic anomalies, and ocular disorders (retinitis pigmentosa).

Recently Zondek and Ticho⁸ showed that some types of exophthalmos are probably of pituitary-diencephalic origin. Even before this work was published, other authors had drawn attention to the possible part played by the thyrotropic factor of the anterior lobe in the genesis of this disease. Among the etiologic factors in this type of exophthalmos, hydration and edema of the external ocular muscles are known to be of importance. The assumption that the antidiuretic factor of the posterior pituitary lobe may be responsible for the occurrence of local water retention does not, therefore, appear to be far fetched.

It is not unreasonable to assume that both pituitary-diencephalic exophthalmos (as designated by Zondek and Ticho) and some types of primary glaucoma may be included under the heading "diencephalopathy." At least, this assumption is not unreasonable in so far as anomalies of circulation or of water-salt metabolism may result in different clinical manifestations in the eye. As with exophthalmos, it should be possible to define certain types of primary glaucoma as "pituitary-diencephalic glaucoma."

The fact that the origin of a number of cases of primary glaucoma can be traced to tissue hydration (corpus vitreum) points to the therapeutic effect of dehydrating measures. It may be assumed that the beneficial effect of thyroidin recorded by Hertel¹ is to be thus interpreted. A few patients to whom we have given mercurial diuretics have stated that they have had at least subjective relief. This hint should be checked by oculists, since it may serve as a supporting measure in situations in which acute action on the increased intraocular pressure is required.

SUMMARY

Sixteen out of 22 cases of primary glaucoma showed, in varying degrees, changes which pointed to the pituitary-diencephalic system. Six of these 16 cases presented pituitary tumors. No pathologic findings could be obtained in 6 of the 22 cases. The question as to how far pituitary hormones (particularly of the posterior lobe) or pituitary-diencephalic factors are to be held responsible for the oc-

currence of primary glaucoma is discussed. "Pituitary-diencephalic" glaucoma is the term suggested to designate those cases of primary glaucoma which exhibit the pituitary-diencephalic symptoms herein described. Such a definition would be analogous to that for the syndrome of pituitary-diencephalic exophthalmos.

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THE PSYCHOLOGY OF THE SQUINTER*

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Although this paper is entitled "The Psychology of the Squinter," it deals mainly with the psychology of the orthoptic treatment of the squinter, and this might be a more appropriate title.

Much has been written on child psychology with emphasis on the psychology of the handicapped and exceptional child. Certainly, I can add nothing to what is already in the literature concerning the psychology of squinters, but I can emphasize the main characteristics of the squinter, and the psychology which should be used by the technician, the parents, and the teacher.

Orthoptics is defined as a method of teaching or restoring binocular single vision by means of graded exercises. It is an educational process, just as much as teaching mathematics is an educational process. To be successful, any teacher must understand something of the psychology of her pupils as individuals. Binocular single vision is a high degree of skill, and if we are to teach it successfully, we must realize that our pupils are individuals with many complex psychologic problems which can, to a great extent, account for their trouble.

Our aim is to obtain a cosmetic and a functional cure; that is, the patient's eyes must not only look straight, but he must have comfortable single binocular vision which he can use in daily tasks. Anything less than this is, strictly speaking, an orthoptic failure. However, to quote Dr. Costenbader: "A lesser grade of cure is better than a cross-eyed child. We should pick the cases for prolonged

orthoptics in which there is the greatest chance for a true cure, and make the other patients happy by simply making them look better."

We must always remember that we are treating individuals and not just a pair of eyes, a convergence excess, or a case of amblyopia ex anopsia. Each patient is an individual problem, a challenge; no two are just alike. It would be simple to classify each patient as to his type of squint and treat him according to a set rule, one step following another. By observing and treating many patients, it is true that it has been possible to establish a pattern of technique for treating each type of squint, but the individual squinter will achieve each skill in his own way. We must first understand the difficulty of the individual and base treatment along those lines best suited to him, in order for him to achieve his goal of comfortable binocular single vision.

Very few young squinters ever complain of visual confusion. They may alternate the fixation, suppress the vision of one eye entirely, or develop anomalous retinal correspondence, and still experience no ocular discomfort. Until they reach the age when the lack of binocular single vision is felt, or until they are made aware that they have crossed eyes, they are quite happy.

The squinting person, child or adult, is as physically handicapped as one who must wear braces or use crutches. The squinter becomes aware that he looks different from others as soon as he comes in contact with children of his own age, usually when he starts to school. It is now customary for children to enter nursery school at two or three years of age. Fortunately, at this age, they are usually very

* Read at the meeting of the American Association of Orthoptic Technicians at Chicago, October 14, 1946.

self-centered, and not observant or critical of one another's appearance. Personal pleasure is their main interest in life. For this reason, the advisability of straightening a child's eyes before he reaches school age cannot be too strongly emphasized. If at the age of six he can start his social contacts with other children with straight eyes, he is spared much unnecessary suffering. The infant squinter, if he is wearing a patch, is usually impervious to the glances and comments on his unusual appearance. One mother told me that she had never realized there were so many thoughtless people in the world until her child wore a patch. Few would ever think of mentioning a deformed limb or a disfiguring mark to the unfortunate possessor or to his sensitive parents, but on seeing a child with a patch, curiosity overcomes them and they want to know if the child is blind in one eye, or how he hurt it. The majority of young squinters are very nervous and sensitive, and these well-meant inquiries make them more conscious of their eyes. The young squinter can be spared a great deal of heartache if he can start to school with his eyes at least cosmetically straight and with his period of occlusion, if that is necessary, behind him.

There is not a great deal that one can do for the infant squinter with orthoptics beyond diagnosing the type of squint and occluding, if that is necessary. His mind is not yet ready for the concentration and will to learn that are absolutely necessary for successful fusion training. If we are to accomplish anything with him, it must be in the guise of play.

The first few visits of the infant squinter are spent in becoming acquainted with him and in convincing him that he is in friendly hands; that he is not going to be hurt. It is usually possible to obtain enough information to determine the type of squint and what treatment: surgery or

orthoptics—or both—will be needed. We can get a fairly accurate idea of the vision with the illiterate "E" chart, picture charts, or the Bailey test. A young child always likes to hold a light and look at it through red and green glasses. We can get a prism and cover measurement fairly accurately, if it is done quickly. In the same way, it is also possible to determine the fixing eye, and get a rough idea of the ocular motility. The child always likes to see the movies, and we can get an objective setting, at least, if the flashing is done very quickly. However, no matter how enthusiastic and coöperative the child is, if he is less than four years old, it is impossible for him to concentrate on one target for more than a few seconds. He simply lacks the power of concentration that comes when he is a little older.

A four-year-old accommodative squinter can be taught to hold his eyes straight but only if he is an exceptionally bright child. Any attempt to force his undeveloped concentration is likely to result in a serious emotional upset and cause him to nourish a deep-seated hatred for any form of eye exercises, which will make it impossible to obtain future coöperation, even though he will then be old enough to learn binocular single vision. At six years, the child has developed some ability to reason. Then, success lies in making him want binocular single vision. Although he is capable of learning to hold his eyes straight in daily tasks, he will never be able to do it unless he desires straight eyes and is willing to work to achieve that goal.

GROUPS OF SQUINTERS

Squinters can be divided into four groups:

1. Can the patient straighten his eyes? If not, then orthoptic training is useless as the error is anatomic and can be corrected only by surgery. After the eyes have been set reasonably straight, post-

operative fusion training can be started.

2. Can the patient recognize his errors? Binocular single vision is certainly a very difficult skill to learn, and it stands to reason that a child with very low intelligence is not capable of learning it. He must understand what is required of him, in order to carry out even the simplest of exercises.

3. Can the patient be comfortable while holding his eyes straight? If he can fuse, but his imbalance is such that fusion is always a distinct effort, he will not use it for casual seeing. In cases such as this, surgery combined with orthoptics gives the best results. In every case, the patient must have comfortable visual habits. If he is not comfortable with binocular single vision, he will revert to his old, incorrect habits of seeing.

4. Does the patient want to use his eyes correctly? Every squinter who has been successfully cured with orthoptics belongs in this class. Without a strong desire for straight eyes, and a determination to have them, sufficient coöperation to effect an orthoptic cure cannot be obtained. Fusion has been defined as the satisfaction of a desire for a single image. If fusion failed to develop spontaneously, the patient must desire it, in order to obtain it. A child must have reached the age of readiness for learning binocular single vision before he can do so. He must have reached the age of readiness for learning any particular skill, if he is to achieve it. Most children start to grade school at the age of six because that is the usual age of readiness for organized learning. It is also the age at which he becomes aware of other people and begins to care what others think of him.

SIX-YEAR-OLD SQUINTERS

The unfortunate child who has to attend school with a noticeable squint or wears an unsightly patch has a great deal

of self-adjusting to do. He is usually oversensitive and high strung. At the age of six, a child is not able to reason that he is just as capable as others, although he does not look like them. His mental development is not sufficient to make him consider the feelings of others less fortunate than himself. The squinter has to bear taunts of "cross eyed," "four eyes," if he has to wear glasses, and many other equally uncomplimentary names. Because of poor vision, he may fall behind in his school work.

Reading is a new and highly difficult skill that he must learn, and one which will be important to him in everything that he does. It requires good binocular coördination of the eyes, and so the squinter is off to a very poor start. He is often a poor athlete and socially he is, perhaps, an outcast because of his appearance. His teacher may fail to understand his plight and keep him in a seat where he cannot see the blackboard or chide him before the class for his slowness in reading or copying his work.

All of these impressions are deep and lasting in a child of this age, for it is at this time that he is very sensitive to the attitude of others. These are his formative years, and during this time he develops into a useful, well-adjusted citizen, or into a psychologic problem. He may develop a deep sense of his own inferiority. Although he may never say anything about it, he feels left out of things and is forced to take a defensive attitude to cope with the situation. He becomes either excessively shy and timid, or he goes to the other extreme and becomes overaggressive. His is the loudest voice in any argument. He bullies younger and smaller children, and is generally a problem both at school and at home.

It follows, therefore, that we not only have to deal with a squint, but sometimes a serious emotional problem as well. If he

has a very noticeable squint, cosmetic straightening of his eyes will produce a marked improvement in his emotional stability. There is always a great change in the attitude of the patient, child or adult, when his eyes have been set cosmetically straight. He at least looks like everyone else, even though he may not have learned to use his eyes correctly. His school work improves and so does his general outlook on life.

If a child is very sensitive about his appearance, he is usually coöperative when he understands that the goal of all of his effort is straight eyes. This desire for straight eyes is sometimes very difficult to inspire in a young child. Usually the best method of obtaining coöperation is to ask him what he wants to be when he grows up, and, no matter what the answer, tell him that to achieve his wish is impossible unless he has straight eyes and uses them together.

KEEPING THE CHILD INTERESTED

Keeping the young patient interested over a long period of training is a more difficult task. He may be enthusiastic at the start, but he is quickly bored if the goal toward which he is working is very distant. I think that praise for each task accomplished does more to uphold his interest than anything else. The future is very distant to a child of grade-school age. He lives for today, and praise for today's work means much more to him than glowing accounts of what he will be able to do in six months. He must be praised for each achievement. Any task given him must be within his ocular and mental capacity or he will be quickly discouraged.

Most children are anxious to please and some will agree to anything. It is soon possible to tell which child lacks the desire to improve to the extent that he is willing to make things easier for himself by giving untruthful answers. He must be made

to understand that he is the one who must do all of the work, and that wrong answers are of no help.

Rewards of any kind are excellent for maintaining coöperation, if they are given only when they are deserved. If the patient does not put forth the effort expected of him, he should have no reward. Some technicians use report cards. At each visit the child receives a star which he is allowed to put on the card. It is gold if he has done excellent work, silver for good work, red, blue, green and so on, down to no star at all for poor attention. He is allowed to choose the star he thinks his application has merited and is usually honest enough to choose the right one. This seems to be an excellent method of maintaining the coöperation and enthusiasm of young children. They are very proud of any stars or report cards received in school, and if the squinter is not doing too well in his regular school work, the stars he receives for doing his exercises well are very welcome. I have a large screen, and each coöperative patient is allowed to draw a picture and hang it there. If he does not give the proper attention to his work, the picture goes home with him. Some technicians use candy as a reward. No matter what the reward, if a child is denied it for poor coöperation, he will usually try to improve at the next visit. Rewards are not absolutely necessary, but they are a great help with many children, when nothing else seems to inspire effort.

In spite of everything we can do, there are times when a child will no longer coöperate, even though he has shown some improvement. He is too conscious of his eyes, and tired of exercises. The best thing for him is a vacation. Let him forget his eyes, and he will come back with a renewed desire to improve.

ATTITUDE OF PARENTS

The attitude of the parents is most im-

portant in the treatment of a squinting child. Complete coöperation on the part of the parents or guardian is the first requisite for successful orthoptic training for children. If the parents understand what is wrong with their child, they are usually willing to do almost anything to help him. The ophthalmologist and orthoptist can explain, in terms which will be easily understood, the results of their tests and what they propose to do. The parents of a squinter must understand his difficulty and allow for his difference from his brothers and sisters. If they are to help their child, however, they must overcome the tendency to defer to all of his wishes to the extent of spoiling him. Mother can do a great deal in making Johnny understand that he must wear his patch. She can encourage him and make his home exercises a game instead of a dreaded task. The squinter who has a happy, well-adjusted home life, with wise and understanding parents, will achieve his goal in a much shorter time than the one who hears constant nagging about his exercises and criticism instead of praise at home.

THE PSYCHOLOGY OF PATCHING

The psychologic aspects of patching deserve special mention. Unfortunately, it is very often an absolute necessity in the treatment of squint. Here again, the desirability of treatment during the pre-school years is evident. Occlusion seldom has an adverse psychologic effect on a two- or three-year-old child. Once he has become accustomed to wearing the patch, he forgets all about it. He must understand, however, that the patch must stay on at all times. Here the coöperation of the mother is most important. If she is firm at the start of the occlusion period, she will have no trouble, but if she lets the child remove his patch at various times, she will find that he is a problem.

When a child reaches school age, patching presents a more difficult problem. He may have difficulty in making friends, or fall behind in his work. He fails at many things and, if not handled properly, develops a genuine feeling of inferiority which produces a kind of paralysis of effort.

After the age of 11 or 12 years, a child may develop such a severe complex that the results of patching are not worth the psychologic havoc which may be wrought. At this age, too, the probability that occlusion will improve vision to any great extent is much more doubtful.

To make a success of occlusion, the patient must be sold on the idea, except in the case of a very young child. We must appeal to his pride, to his future ambitions, or to his vanity to make him understand the value of two good eyes.

We all have to cope with the problem of peeking over, under, or around the patch. Many children mean well, and make solemn promises not to peek, but do so anyhow. The most successful method of avoiding this would seem to be by having patches which exclude all light from the eye. If the vision of the amblyopic eye is so poor that his activities are greatly limited, it is almost impossible for a child not to try to use the occluded eye if it is at all possible. Any child who persists in peeking when he is wearing an Elastoplast patch, is not sold on the idea, and probably will not improve unless his attitude is changed.

Constant encouragement makes the period of occlusion easier for both patient and parents. Any improvement, no matter how small, is welcomed; and for this reason, it is well to check the vision of the patient frequently, especially when he first starts to wear his patch. It is well, too, to be able to show the parents that the occluded eye still has good vision, for they invariably worry about it. The child

thrives on praise for any tasks which he can accomplish well, and accepts extra help with those tasks causing difficulty. Praise, instead of criticism, will help him more than anything else.

As the patient grows older, chances of a marked improvement of the vision in his amblyopic eye decrease. This should be carefully explained to him, and he should be allowed to make the choice of whether or not to wear a patch. If he has a goal which requires equal vision in his two eyes—the Naval Academy, West Point, and so forth—he will try anything to regain his vision.

SUMMARY

The success of orthoptic training de-

pends on the desire and will of the patient to learn the skill of binocular single vision. The development of this will to succeed depends largely on the teaching ability of the orthoptist. She must present exercises in the way that will be most readily accomplished by each patient. She must analyze the problem of each patient and find out what can be done with a maximum of effort. Then the patient's desire for success must be stimulated. As soon as he has learned one skill, he should start immediately to learn the next. Above all, we must think of our patients as individuals, not cases. We must never forget the human element involved.

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NOTES, CASES, INSTRUMENTS

HEMORRHAGE IN SARCOMA OF THE CHOROID*

A CLINICAL PATHOLOGIC REPORT

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HISTORY

H. M., a 55-year-old white man, had noticed for the past two weeks an occasional "shadow" in front of his left eye which he thought might be caused by his heavy, bushy eyebrows. He often tried to brush it away but it recurred frequently. On the day before he was examined, he noticed a sudden loss of vision of the left eye. There was no preceding trauma and no associated pain, headache, nor inflammation of the eye. The right eye was normal in all respects with 20/20 vision. The left eye had vision limited to hand movements in the lower field. The globe was normal externally. The media were clear. The left fundus revealed a large, rounded, smooth detachment in the entire lower portion of the retina extending up to and beyond the macular area. The area of detachment was partly lobulated, and there was no transmission of light through the detached area on transillumination. Most of the detached area gave the impression that it was due to a hemorrhage but in the lowest portion there was some mottled pigmentation which Dr. Webster described as having the appearance of the "mottled coloring sometimes seen on a grapefruit." On the patient's admission to the Manhattan Eye, Ear, and Throat Hospital, it was found that his blood sugar content was 280 mg. percent and that the urine contained 5

percent of sugar. Under treatment for three days with insulin, the blood sugar content was brought down to 120 mg. percent, and the urine was sugar free. X-ray pictures of the chest, long bones, and spinal column were negative for metastases. When the eye was enucleated,

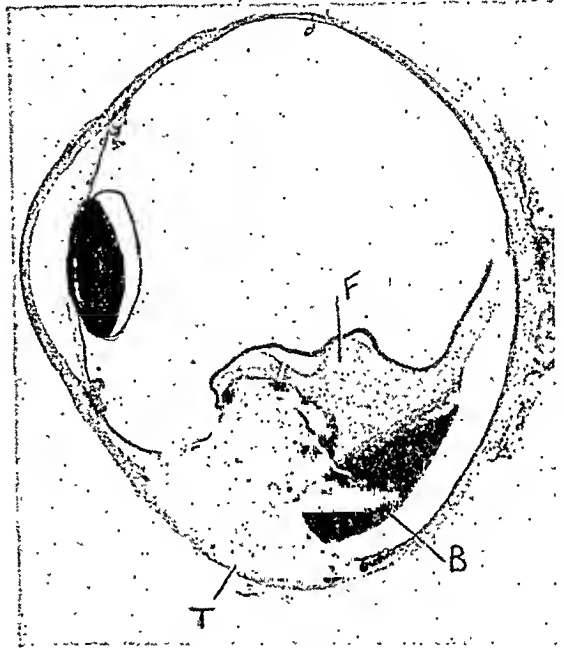


Fig. 1 (Laval). A cross section of the enucleated globe showing the mushroom-shaped tumor arising in the choroid and the large subretinal hemorrhage. T, tumor; B, blood; F, subretinal fluid.

there was profuse bleeding which persisted for one hour after which a gold ball was put into Tenon's capsule.

PATHOLOGY

The globe was normal in its gross appearance. On section a large hemorrhage was seen occupying approximately one third of the vitreous area. No tumor was seen until several sections were prepared for staining when a mushroom-shaped mass was seen protruding into the vitre-

* From the laboratory of the Manhattan Eye, Ear, and Throat Hospital.



Fig. 2 (Laval). There are many blood vessels in the tumor mass. V, blood vessels surrounded by tumor cells.

ous below, with blood settling toward the optic nerve and causing detachment of the retina. There was no extraocular mass.

MICROSCOPIC APPEARANCE

The anterior segment of the globe is normal. On the side opposite the tumor mass, the retina is firmly in place. The tumor mass arises in the choroid and consists of mixed round and spindle-shaped cells, closely packed, some in whorls, with much pigment and many blood spaces. At the head of the mushroom-shaped growth, some of these vessels have been perforated by the tumor cells causing a profuse hemorrhage with further detachment of the retina. The detachment extends from

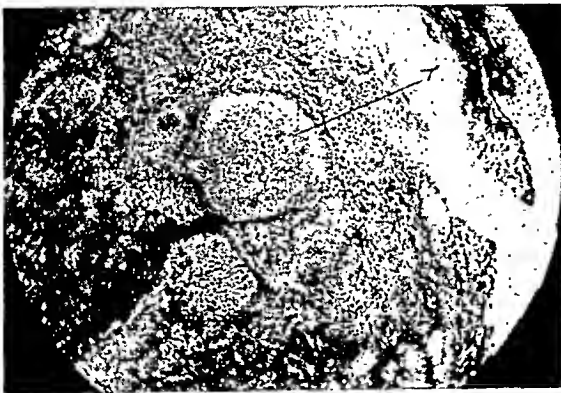


Fig. 3 (Laval). The tumor cells have eroded the dilated vessel walls causing a hemorrhage. T, tumor cells invading a blood vessel.

the region of the ora serrata to the optic nerve. The choroidal vessels in the region of the tumor are quite engorged in contrast to the normal condition of the choroidal vessels on the side opposite the tumor. No emissaria are involved in the sections studied and the optic nerve is not invaded. A Wilder stain shows almost complete absence of reticular supporting fibers throughout the tumor mass.

COMMENT

The differential diagnosis between sarcoma of the choroid and subretinal hemor-

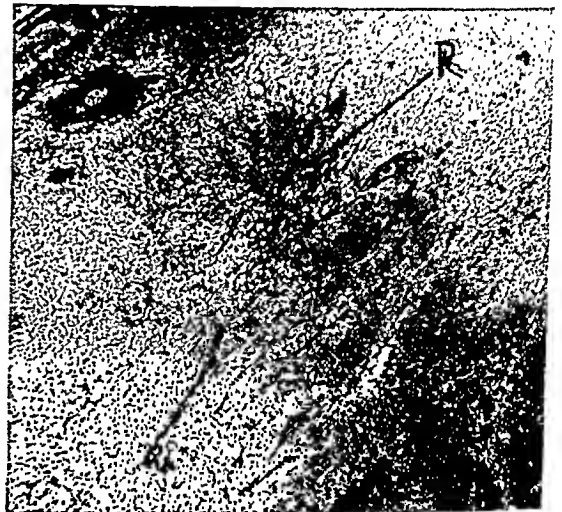


Fig. 4 (Laval). The Wilder stain (a silver stain) shows hardly any connective-tissue fibers in the tumor mass. R, reticular fibers.

rhage is often difficult. It is not unusual to see enucleated globes with a subretinal hemorrhage and no tumor, when the clinical diagnosis was choroidal tumor. The combination of both lesions, however, is quite rare and to make the correct diagnosis of tumor as responsible for the hemorrhage is extremely difficult. When a diagnosis of diabetes was established in the case herein reported, the inclination toward hemorrhage as against tumor must have been tempting, but it is to be remembered that diabetic hemorrhages are in the retina and vitreous and not subretinal.

While the sarcoma was encroaching on the vitreous chamber, the patient noticed only a slight interference with his upper field as an occasional flitting shadow. When the neoplastic process eroded the choroidal vessels with resultant profuse subretinal hemorrhage and detachment of the retina up to and beyond the macula, the effect on vision was sudden and catastrophic.

The prolonged bleeding which ensued after enucleation is explained by the use of insulin for three days prior to surgery. This was responsible for a change in blood volume. One should be very careful about the intensive use of insulin in diabetes prior to surgery of any sort.

The Wilder stain of the sections demonstrates the paucity of connective tissue supporting fibers, which is indicative of a very high level of malignancy with propensity for metastases. The tumor cells were of the mixed type, some being spindle-shaped and arranged around vessels and others rounded or epithelioid in nature. The spindle-shaped cells are less malignant in nature than the epithelioid cells. The amount of pigment scattered in the tumor was not profuse but this is of no significance as to degree of malignancy. The pigment is manufactured by the tumor cells themselves and is an indication of their reversal to their embryonic nature.

136 East 64th Street (21).

A COMBINATION RED FILTER AND OCCLUDER*

W. L. HUGHES, M.D.
Hempstead, New York

This instrument consisting of a ground-plastic red filter blackened on one end

* Made for me by Clairmont and Nichols,
517 Madison Avenue, New York.

with a handle in the middle was originally designed to simplify the technique of the parallax test.

For this test the red filter is placed over one eye, for example, the left eye with the opaque portion over the right eye. If a small, commercial green light at 20 feet is used for fixation, the patient sees only a red light. If the red portion is then moved off to the side, placing the opaque portion over the left eye and uncovering the right eye, the patient will then see only a green light. If the instrument is then moved back and forth between these two positions fairly rapidly, the patient will see alternately a red and a green light with the left and the right eyes successively. If the red light is higher than the green, a right hyperphoria is indicated. The proper neutralizing prism base down before the right eye measures the amount of hyperphoria. The horizontal balance is similarly measured. Only one hand is needed to make the complete change, leaving the other hand free to manipulate prisms.

The instrument measures 3.5 cm. by 9 cm. with a handle placed at right angles to one side. The black portion of the instrument may be used as an occluder for taking vision or performing the alternate cover test. Gross fusion may also be checked by placing the red filter over one eye, leaving the other eye uncovered, and then alternately covering and uncovering one eye with the red filter. If the patient sees a mixed red and green alternating with a plain green light, fusion is taking place. If separate red and green lights are seen when the red filter is in place over one eye, diplopia is present and it is possible to analyze the diplopia.

This instrument combines in simple form a red filter and occluder with which one can perform several tests and gain considerable information in a short time.

131 Fulton Avenue.

A STUDY OF TUBULAR AND SPIRAL CENTRAL FIELDS IN HYSTERIA*

THOMAS H. EAMES, M.D.

Belmont, Massachusetts

Concentrically contracted (or tubular) visual fields are variously regarded as symptomatic of hysteria. Ford,¹ May,² and Tassman³ have listed such fields as at least suggestive of hysteria. Yasuna⁴ presented 15 cases of hysterical amblyopia, 14 of which exhibited tubular fields, and Halpern⁵ reported 15 cases of hysterical amblyopia in which the field tracings were usually tubular. May suggested that the spiral field might be included here. In such cases, progressive contraction is noted *during* examination. Berens and Zuckerman⁶ listed spiral fields as being due to fatigue or functional causes, while Peter⁷ and Traquair⁸ were of the opinion that spiral fields occur in neurasthenia rather than in hysteria. Discussion with medical and psychologic colleagues mirrored this variation in opinion. The present study was undertaken to contribute further data to the subject.

The normal central field⁹ as tested on a tangent screen at 750 mm. with a 1-mm., white test object extends nasally 26 degrees; temporally, 33 degrees; superiorly, 26 degrees; and inferiorly, 28 degrees. Tubular fields are concentrically contracted with the same isopter distance in all meridians. Their extent is variously estimated up to about 25 degrees. The criterion used in this study was concentric contraction to 15 degrees or less from the fixation point as determined with the tangent screen under the conditions described in the opening sentence of this paragraph.

Of the 193 unselected school children

examined, 9 percent exhibited tubular central fields. The median age of these pupils was 9 years, 11 months. The median extent of their tubular fields was 9 degrees, with Q_1 , 7 degrees, and Q_3 , 10 degrees. The tubular field chartings exhibited no marked variation with changes in the test distance as normal fields tend to do. One child presented a spiral field but displayed no other evidence of hysteria or neurasthenia.

Forty-four percent of the cases with tubular central fields exhibited amblyopia sufficient to reduce visual acuity to 20/30 or less; while 11 percent showed amblyopia with visual acuity of 20/150 or less. Eighty-three percent of the tubular, central-field cases were failing in their school work in one or more subjects. Hysteria was suspected in 77 percent of the cases, and a positive diagnosis of hysteria was made in 33 percent; a provisional diagnosis, in 44 percent. Twenty-three percent of the cases exhibited no other symptom or sign of hysteria.

One of the cases presented a confused picture. This patient was failing in school, exhibited signs of hysteria, including a moderate amblyopia and tubular central fields, but he also had a concurrent illness which might have caused either or both visual impairment and central-field restriction. Unlike the others this patient's field returned to normal very slowly over a period of 14 months, during which time he received remedial teaching as well as therapy for his concurrent illness. It is impossible to determine which condition was responsible for the tubular central fields in this particular case.

Forty-four percent of the tubular central-field cases were rechecked at various intervals averaging 12 months in length. All exhibited central fields of normal size and shape when rechecked except for the single case with concurrent disease.

This study supports the contentions

* From the School of Education, Boston University, Boston, Massachusetts.

that: (1) tubular central fields occur frequently but not necessarily always in cases of hysteria; and (2) tubular central fields and amblyopia together are frequent but not invariable manifestations of that condition. It is my opinion that both these manifestations when taken together are a more reliable indication of possible hysteria than either one taken alone, since there are diseases which can influence either central fields or visual

acuity in such a way as to confuse the picture beyond reliable interpretation. Therefore, when visual acuity measurements and central-field chartings are used in examinations for hysteria, a diagnosis should not be made on the mere presence of either or both of these conditions, although the demonstration of either or both should suggest the possibility of the presence of hysteria.

560 Pleasant Street.

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- ⁹ See reference No. 6.

A FIXATION LIGHT FOR THE CARDINAL DIRECTIONS OF GAZE*

WILLIAM COUNCILMAN OWENS, M.D.
Baltimore, Maryland

The deviations of the eyes in the six cardinal directions of gaze should always be measured in the routine study of ocular motor anomalies. To make these measurements quickly and accurately, certain important factors should be controlled and standardized. The measurements should be made with the head erect to eliminate changes in the tone of the ocular muscles induced by turning and tilting the head on the neck.¹ In addition, the measurements should be made with the eyes at

constant, standard angles of rotation from the primary position. Only by such standardization are the measurements reproducible, or comparable with measurements made on different patients or on the same patient at different times. The best method of making these measurements is by the use of the prism cover test while the patient fixates a light, for this method reveals most about the ocular muscles. In measuring the deviation by this method, the observer is constantly watching the action of the muscles as the eye moves to take up fixation. White² stated that the prism cover test "makes for much keener power of observation, and for an intimacy with the functions of the ocular muscles which cannot be acquired by any other test."

* From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University.

Although many instruments³ have been devised to facilitate measuring the deviation in the six cardinal directions, the use

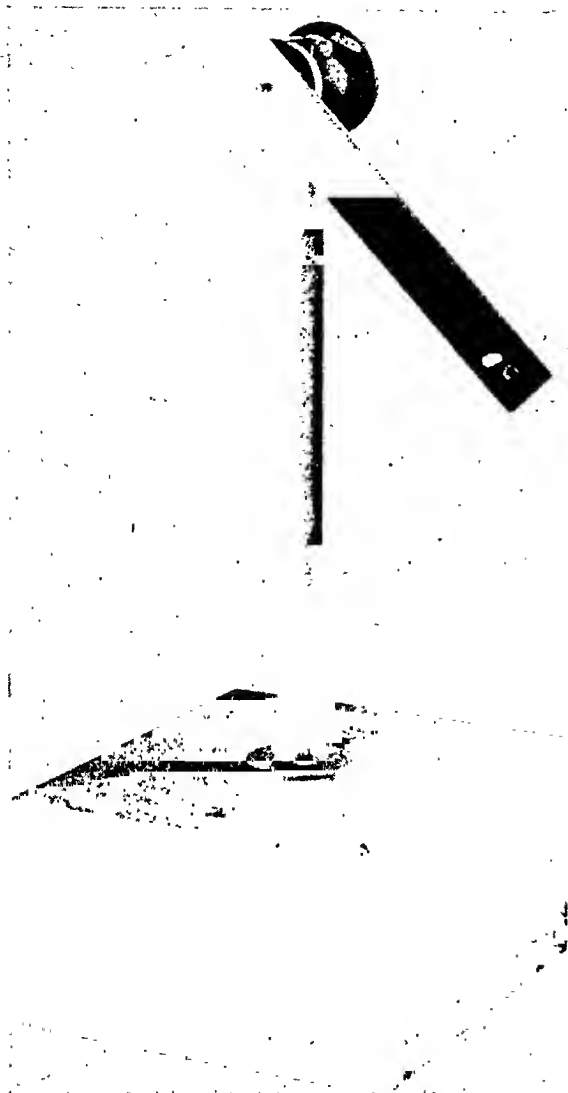


Fig. 1 (Owens). Fixation light for the cardinal directions of gaze.

of the prism cover test with the patient fixating a light remains the method of choice. A simple fixation light for the cardinal directions of gaze has been constructed.[†] It provides a method of placing a fixation light in standard positions of gaze in the six cardinal directions. A similar method of fixation was used by Friedenwald⁴ in measuring anisophoria with a phorometer. The instrument (fig. 1) consists of a base with an upright bar, 33 cm. high, to which is attached a rotating arm, 19 cm. long. The arm rotates around the

upright bar and is provided with automatic stops that place the arm in the six cardinal meridians of gaze. Two bulbs on the rotating arm are used for fixation. One is placed at the center of rotation of the arm. It remains stationary when the arm is turned and is used for fixation in the primary position at 33 cm. The other bulb on the rotating arm is placed 15.4 cm. from the center of rotation. It moves into the six cardinal positions of gaze as the rotating arm is turned into the six standard meridians. When the patient's eyes fixate the peripheral light, their constant angle of rotation from the primary position of gaze is 25 degrees in each of the six cardinal directions.

The instrument is used on a table with an adjustable head and chin rest (fig. 2). The central light is placed directly in front of the patient at a distance of 33 cm. First the peripheral light is turned off, and the patient fixates the central light while the deviation of the eyes in the primary position for near is measured by the prism and cover test. Next the central light is turned off, the peripheral light illuminated, and the arm placed successively in each of the six cardinal meridians. While the patient fixates the peripheral light, measurements of the horizontal and vertical deviations are made by the



Fig. 2 (Owens). Fixation light for the cardinal directions of gaze being used with the prism cover test.

[†] Built by Mr. Albert Goebel in the machine shop of the Wilmer Ophthalmological Institute.

prism and cover test in each of the six cardinal directions of gaze. The light is easily shifted from one position of gaze to the next by simply rotating the arm until it comes to the next automatic stop.

This instrument is extremely useful for it standardizes the position of gaze in the six cardinal directions. With it, measurements can be made more quickly and accurately, for the operator's hands are free, and there is adequate, unencumbered working space. The action of the

eyes can be easily visualized by using the prism cover test, and the corneal reflex of the uncovered eye can be watched constantly. The instrument is simple and can be used readily with both adults and children. It is particularly helpful with children, for the head is held in a constant position and the child enjoys watching the fixation light swing into the cardinal positions of gaze as the arm is rotated into the six meridians.

Johns Hopkins Hospital (5).

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PATHOGENESIS OF FUNDUS CHANGES IN SKULL INJURIES*

Z. KAMINSKAYA-PAVLOVA, M.D.

Moscow

Skull injuries, as is known, are frequently associated with fundus changes. The pathogenesis of these changes is not always clear, especially if the fundus changes develop some time subsequent to the trauma, and there are no signs in the central nervous system (abscess, meningitis) to account for the fundus changes. Such circumstances always complicate the management of the case. Usually in such cases therapy is symptomatic, not

etiologic which makes it less effective.

We would like in this brief presentation to call attention to one factor which sometimes plays a dominant role in the development of various posttraumatic changes. This factor may be the background against which the posttraumatic picture develops.

On one hand, trauma may serve as the stimulus which awakens within the organism a latent pathologic process; on the other hand it weakens the organism and lowers its resistance so that a hidden pathologic process becomes virulent. For instance, numerous cases of luetic parenchymatous keratitis, which set in following an injury, have been reported in the literature. It is also known that in cases of tuberculous allergy, the traumatic

* From the third Moscow Medical Institute.

site fixes the bacterial metastasis. This was demonstrated through numerous experiments for various organs, including the eye (Rappoport, Kaminski).

Clinical observation also demonstrates that trauma not infrequently leads to the development of tuberculosis in the traumatized organ. For instance, cases of a perforating ocular injury followed by a tubercular process, and diagnosed histopathologically, have been reported.

All this testifies to the important role of the background against which the traumatic process develops. The importance of the premorbid state is so great that not to recognize its importance in the analysis of the pathogenetic factors would be a grave error.

CASE REPORTS

Several cases under our care serve as vivid illustrations of this situation, and we therefore report them briefly.

Case 1. A man, 40 years of age, was seen because of rapidly diminishing vision. This condition developed after a comparatively mild bump of the forehead against an iron rod. The patient did not lose consciousness, but was dizzy for some time. Immediately after the injury, he noticed rapid diminution of vision. One month later at the time of examination, vision was: 0.03 and 0.04. The fundus revealed a descending atrophy of the optic nerve. A careful neuropathologic examination made one suspect lues. An analysis of the cerebrospinal fluid, as well as the subsequent clinical course, confirmed the diagnosis.

In this case, it would seem that the injury served as the stimulus for the development of a process, which might have developed anyway. Trauma, however, hastened development of the disease and made the prognosis unfavorable. The patient rapidly became blind.

Case 2. Even more interesting is this case of moderately pronounced oxycephaly. The fact that the man was a sniper justifies the assumption that his vision was good. During a battle he suffered a contusion. Following the injury he began to suffer persistent pain in the head, and vision began to fail. Examination revealed a secondary optic atrophy. Visual acuity was 0.01 in each eye. There is the possibility that the optic atrophy preceded the injury, because it is frequent in oxycephaly. However, a record of good visual acuity prior to the injury indicates that, even if the patient did have an optic atrophy, it did not affect his vision. The injury, having fallen on fertile soil, resulted in the rapid development of a process which ended in almost total blindness.

For purposes of observation the patient was placed in the neurologic clinic, where it was found that he had arachnoiditis with raised intracranial pressure. In the opinion of the neuropathologist, the raised intracranial pressure was undoubtedly related to the oxycephaly. The literature contains the description of a similar case (Birm) in which, after an injury, a man with oxycephaly suffered rapid deterioration of vision. He had an optic atrophy.

Case 3. This case is unique. A woman with Raynaud's disease suffered a skull injury in an automobile wreck. Following the injury, she developed a cerebral form of Raynaud's disease with attacks of acute cerebral anemia. During these attacks, we could observe sharply pronounced arterial spasms in her fundus. Thus, the trauma served to transfer the site of the disease from the extremities to the central nervous system.

Case 4. This case deals with a skull injury in a hypertensive patient. A woman, 45-years-old, with vascular hypertension

fell and injured her head. There was a brief loss of consciousness, with dizziness and headache.

At the first examination it was found that she had peripapillary edema. Her general condition became aggravated; she began to have attacks of unconsciousness and was hospitalized. Her blood pressure was high (170/105 mm. Hg.) After two months of hospitalization, she was discharged in a satisfactory condition. The attacks recurred and soon she developed markedly choked discs. She was again hospitalized. Repeated lumbar punctures led to considerable improvement; the choked discs disappeared, leaving slight edema. Soon after discharge from the hospital, symptoms again recurred, and vision, which until then was normal began to fail.

The neuropathologist explained the case in the following manner: "An insignificant trauma gave rise to serious complications and an unfavorable course, only because the patient had hypertension. Hypertension in this case formed the background which determined the character of the clinical course of the disease, giving it a grave form, not associated with light trauma."

Case 5. A man, aged 30 years, developed a descending optic atrophy with vision reduced to 0.3 following a skull injury during a bombardment. The trauma was light; there was no loss of consciousness; the visual loss was gradual, beginning with a central scotoma which gradually disappeared. The history revealed that this was the third skull injury sustained by this patient. The first was during infancy when he fell from the roof of a barn. The last two injuries were sustained within 1½ years during the war. The last injury resulted in more severe complications than the other two. In addition to optic atrophy, it caused

neurologic symptoms such as headache, dizziness, paresthesia, and so forth. The case was regarded as a traumatic arachnoiditis caused by repeated injuries.

DISCUSSION

These five cases, with the common etiology of injury to the skull and different backgrounds against which posttraumatic symptoms developed, demonstrate the importance of a careful study of injuries.

Among posttraumatic changes, optic atrophy is a frequently encountered phenomenon, and yet, it is frequently difficult to understand why an optic atrophy should develop following an injury, particularly if it was slight. The pathogenesis of optic atrophy is clear in cases in which there is bone injury, and in those in which a fracture of the optic canal is suspected. Sometimes the cause of the optic atrophy is a hemorrhage into the meninges of the optic nerve. Complications such as meningo-encephalitis or abscess of the brain may also lead to optic atrophy.

Along with these more familiar cases, we encounter cases which we do not understand. In such cases it is important to get a detailed history and make a careful examination. Congenital anomalies, previous illness or trauma, the presence of latent pathologic processes (lues, malaria, tuberculosis, hypertension, septic foci, and so forth) may serve as fertile soil for the development of posttraumatic complications. Not only may these conditions initiate development of the disease, but they may also aggravate its clinical course. Demonstration of these factors facilitates understanding of the processes involved and helps in the application of rational therapy.

4th Sokolnicheskaya Street (11).

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

May 6, 1946

DR. MAURICE L. WIESELTHIER, *presiding*

DANGER OF PENICILLIN IN ACTIVE UVEITIS

DR. ELTON YASUNA said that, after intramuscular injection, only low levels of penicillin are found in the aqueous, even with massive doses. The most satisfactory aqueous concentration is obtained by topical administration, using penicillin-saturated cotton packs in the lower fornix. In severe infections, injections, both subconjunctival and directly into the aqueous, have been employed, but these cause irritation.

Penicillin has been found to be effective in the treatment of the purulent infections of the external eye. However, in uveitis most reports show that penicillin is not effective.

Two case histories were presented. Both patients had uveitis, possibly Neisserian in etiology. In each instance, the uveitis was subsiding under the usual therapy when intramuscular penicillin was begun for the chronic urethritis. The uveitis became worse, and the penicillin treatments were stopped, following which the eyes rapidly became quiet.

A possible explanation for this exacerbation was proposed. The inflammatory process in uveitis is probably not a result of direct bacterial invasion, but rather due to tissue sensitivity from bacterial end products. Also, it has been shown that the action of penicillin is bactericidal. Therefore, penicillin administered systemically

causes destruction of bacteria in the focus of infection. This liberates more bacterial end products into the blood stream, which further aggravates the active uveitis.

It was suggested that penicillin should not be used in active uveitis because its therapeutic value is doubtful, and because it may actually be dangerous.

PLASTIC SURGERY OF THE EYELIDS

DR. WENDELL L. HUGHES places emphasis on the division of the lid into two layers, surgically, cosmetically, and functionally. When less than one fourth of the upper lid is missing, the remaining portion of the lid can frequently be pulled together and joined with a tongue and groove joint, supported by a flap of skin just back of the lid margin. When one fourth to one half of the lid is missing at either the nasal or temporal sides, the remaining portion of the lid can usually be divided into two layers and one layer slid across into the defect. It is usually better to slide the tarsoconjunctival layer across into the defect and then put a skin graft over this area. The tarsoconjunctiva is left attached to the levator.

When the upper lid is entirely missing, a major procedure with several steps is necessary. First, the conjunctiva must be brought across the cornea to protect it. The conjunctival surface is kept in contact with the corneal surface. Skin is then slid from nearby areas to give a double layer over the eye with which to start. Additional skin must usually be provided. Tarsoconjunctiva as a free graft can be taken from the opposite upper lid, if it is normal. Skin is taken from the opposite upper lid, and lashes for the upper lid are taken from the brow on the

same side. An almost complete blepharorrhaphy is maintained for the duration of the several stages in the reconstruction of the upper lid. It usually takes more than a year to complete the reconstruction. If the levator has been severed, it may need to be reattached to the newly constructed upper lid. A tarsorrhaphy or blepharorrhaphy is almost always necessary in reconstructing any major portion of the upper lid.

USE OF FREE-SKIN GRAFTS

DR. J. EASTMAN SHEEHAN illustrated his new method of dealing with free-skin grafts, explaining that, although in the beginning there was a 50 percent loss, now there is practically none. The advance was illustrated by a case in which, under his method, sutures are not necessary. Circulation is reestablished so rapidly that overlapping edges, if allowed, bleed when cut on the second day. Definite recovery is achieved on the 14th day, and in two months the graft cannot be distinguished from its surroundings.

What is new about the method is the addition of certain blood elements. At the time of operation the patient himself supplies blood drawn by an aspiration needle. It runs to 10 cc. capacity. To maintain fluidity, 1 mg. of heparin and 1 cc. of Tyrode's solution are added. This overcomes the tendency of a graft to shrink. The graft, made fast to gauze, is transferred to the wound area, which it precisely fills. A margin of the gauze holds it in place.

The graft is held firmly in place by an extract from the blood. After the blood has been centrifuged for 20 minutes, there is clear plasma at the top, a thin film of white cells, and the red corpuscles. These last do not enter, but the other two do. The recipient area is painted with the plasma. The under side of the graft is also painted, a different color.

With the rubberized fabric held up by an assistant, the operator guides the graft to its place. Fixation is complete. The particles from the blood hold the graft in place.

The process of recovery is interesting to watch. The graft takes on a purplish tinge after five hours, gives signs of life after 10 hours, is a full purple on the third day, a definite pink on the 14th day.

Discussion. Dr. Raymond E. Meek described the operation he has devised for the correction of entropion. He stated that the circular fibers of the orbicularis oculi have two directions and functions. The circular fibers which run around the eye elevate the lower eyelid by contracting and flattening the arc, while at the margin of the lower lid they curve in the horizontal plane pulling and holding the lid against eyeball. He changes the direction of these fibers, which cause the spastic entropion, and corrects the condition by making a horizontal incision the full length of the lid and 3 mm. from the margin. The skin is undermined and two tongues of the exposed orbicularis are dissected so that they remain attached at the center of the eyelid. Incisions from below the center are made downward and laterally to the orbital margin and with catgut, tongues of orbicularis are sutured to the periosteum without any tension. The skin is closed with interrupted silk sutures.

Dr. Clarence R. Straatsma said that plasma glue was used for a time at the Brooklyn Naval Hospital. While the results were favorable, its use was ultimately discontinued because the frequent change in personnel made it necessary to train new help repeatedly. It was found that the procedure was more uniform and stable when more thrombin was used.

Dr. Sidney A. Fox said that he was happy to hear Dr. Hughes say that it is rare to achieve results equal to the normal

condition. He agreed with Dr. Hughes's use of tarsal cartilage to replace tarsal cartilage and said that he always tries to replace tissue with the same tissue although there are usually several methods of correcting any particular condition.

Slides illustrating several cases were shown. In several of these preserved cartilage was buried under the skin and after a few weeks the skin and the now adherent cartilage swung into position on a pedicle to the skin-tarsal layer of the new eyelid.

Leon H. Ehrlich,
Secretary.

LOS ANGELES SOCIETY FOR OPHTHALMOLOGY AND OTOLARYNGOLOGY

SECTION ON OPHTHALMOLOGY

May 27, 1946

DR. GEORGE P. LANDEGGER, *presiding*

AN IMPROVED PROCEDURE IN PROSTHESIS PLASTIC SURGERY

DR. S. V. ABRAHAM presented a preliminary report on a new technique for evisceration with sparing of the cornea and scleral implantation. He pointed out that the only similar technique for evisceration with saving of the cornea was brought out by Burch in 1939.

In Burch's technique, the conjunctiva is dissected free of the limbus for four fifths of the limbus. The sclera is exposed for an area about 5 to 6 mm. from the limbus. The sclera is then incised about 5 to 6 mm. from the limbus, and the incision enlarged, running more or less parallel to the limbus and through four fifths of the circumference of the globe. The evisceration is then completed, including scraping of the posterior surface of the cornea. An implant is inserted and

the scleral wound is closed. The conjunctiva is sewed to the limbus area. Dr. Abraham pointed out that Burch's technique leaves the scleral wound anterior and in close contact to the conjunctival wound. The opening, he said, encircles the globe for four fifths of its circumference.

Dr. Abraham described his technique as follows: A conjunctival incision running parallel to the limbus is made temporally about 7 to 8 mm. from the limbus. The incision runs approximately from the superior rectus downward for about $\frac{3}{4}$ to 1 inch. The sclera, he stated, is exposed anterior and posterior to the conjunctival incision, the conjunctiva being retracted. The external rectus muscle is identified. The sclera is incised parallel to the upper rim of the external rectus muscle and 2 to 3 mm. above the same. The incision is carried backward and forward as far as desired to permit not only easy access to the ocular contents, but also the implantation of a large ball. The anterior end of the scleral incision should be at least 2 mm. from the limbus. He went on to say that after removing the ocular contents (and scraping the posterior corneal surface if desired), the implant is placed within the sclera, using as large an implant as possible (18 to 22 mm.), and the scleral wound is closed with interrupted mattress sutures. The conjunctiva may be closed with a running suture.

This technique permits scleral implants of larger size, with minimum danger of extrusion. The deep incision contacts the superficial incision in only one point. Dr. Abraham said that the incision runs in the direction of the major pressure from within the globe and the orbit, so minimizing the possibility of extrusion. He pointed out that the final result is a larger stump, with greater retention of the normal conjunctival tissue and folds,

thus making for better cosmetic results.

He also emphasized that better results occur with the preservation of a maximum stump, the maximum retention of a normal conjunctival sac, and the use of a minimum sized artificial eye. Saving of the cornea is essential for the retention of a maximum conjunctival sac.

Discussion. Dr. G. Zugsmith reviewed his observations of more than 1,000 cases in the army. These cases, he said, had had enucleation without implantation, enucleation with implantation, evisceration without scleral implant, and evisceration with scleral implant. Some of his cases had been operated as long as 25 years before observation, and some cases were done only a short time before observation. Dr. Zugsmith observed that surgery had similar pathologic results in all the cases; that is, there was a shrinkage of the orbital tissue with a contraction or atrophy of the conjunctiva, and a tendency of the orbital contents to sink to the floor of the orbit. Dr. Zugsmith found that these pathologic changes were least in cases of evisceration with scleral implant, and most with enucleation without implantation. He found that the cosmetic results were, therefore, best with evisceration and scleral implant. He reported that his experiences did not include scleral implant with saving of the cornea.

C. H. Albaugh,
Reporter.

SOCIEDAD OFTALMOLOGICA DE MADRID

May 31, 1946

BILATERAL GLIOMA OF RETINA

DR. MARIO ESTEBAN presented a case of bilateral glioma of the retina. A boy aged two years, whose right eye has already been removed for glioma of the retina, now shows in his left eye the ex-

istence of a tumor of like malignancy. You are all familiar with the prognosis as to life of such a condition. The case is as interesting from the clinical standpoint as it is touching from the human standpoint because of the dilemma as to whether to enucleate the second eye.

What else can be considered except enucleation? For the past few years radiotherapy has been tried and conscientiously followed. In the beginning, the tumor showed evident regression from the effect of the radiation, but now it seems to be moving again toward the papilla. Should we persist? Should we continue with such treatment? Or should we decide on an operation?

The results of the roentgen therapy in glioma of the retina are not conclusive. There are those who claim that X-ray treatments can cure a glioma and preserve the eye. Others maintain that every glioma will end fatally as regards the eye and life itself if enucleation is not done in time. They advise treatment with X rays—not to avoid an operation, but as a complement to it—before an operation in order to prevent metastasis and afterward to prevent recurrences, or both before and after for the double purpose indicated.

Radiotherapy is a valuable device which should be considered in tumors of this kind. We can and we should try it first in all such cases, but we cannot and should not trust in it exclusively. We have to observe the effects, watch developments, and be prepared to enucleate if necessary before extensions and metastasis develop. We must keep in mind that blindness cannot be avoided by not operating because the glioma itself destroys the eye. The operation at least will save the child's life.

In case of such a tumor in both eyes, which occurs unfortunately all too frequently, we ought to at first apply radio-

therapy. But if this fails in one eye or the other we must enucleate both eyes. It is our duty to do so, cruel and painful as the process may seem. There are no scientific, ethical, or social reasons to allow the child to die. On the other hand, blindness is not a renunciation of life; it is perhaps a more subjective and a more intense life, and the blind are not more unfortunate or less useful to society than the majority of those who see.

Glioma of the retina not only constitutes a very important clinical problem, but also a social problem. It has been proved that some adults, who were afflicted in infancy with glioma of the retina and whose eyes as a result were enucleated, bear children who also suffer from the same affliction, which shows that glioma is hereditary. Enucleation and the subsequent application of X rays are definitely indicated, and there is nothing else to do.

Discussion. Dr. Garcia Mansilla said that the case of double glioma of the retina which Dr. Mario Esteban presented to us is very interesting from a medical and moral aspect. From the first aspect, I believe that Dr. Esteban would act very well in enucleating the eye and then applying radiotherapy to the orbit in order to avoid the recurrence of the neoplasm. I believe that having the glioma already manifest in the other retina it is likewise necessary to do another enucleation, preceded and followed by radiation. In this way, it is possible to avoid the recurrence and metastasis of the neoplasm in distant organs. From the moral aspect, it is truly painful to enucleate the single eye which the boy has, although vision is rather poor. However, considering that whatever vision he has will shortly be lost and that the operation is the only way of saving life, I believe it is proper to convince the father of the patient that he should authorize the operation, because he cer-

tainly would prefer that his child should live even though blind. Moreover, we must also remember that when sight is lost early in life the individual adapts himself to his new condition easily and such blind individuals are as happy as many seeing ones. Bearing out this point, I know a man, aged 56 years, who as a child suffered double choriocyclitis, as a result of which he became completely blind, did not even see the slightest ray of light. I took care of him some 50 years ago. He now lives happy and contented. He is a masseur in an important establishment in Madrid and has many high-class, private patients and earns a good livelihood.

Dr. Carreras said that he entirely agreed with Dr. Mario Esteban in the manner in which he is handling this case of bilateral glioma. The enucleation of the second eye is important in order to save or try to save the life of the child. This is the first duty of the doctor even though it shows the failure of the ophthalmologist. The sacrifice of the other eye is most difficult for the parents. The child at this young age can receive an education which will enable him not only to be happy but also to be useful to his country. There have been many blind men who have become outstanding.

Dr. Galindez Rivero congratulated Dr. Mario Esteban for the presentation of his interesting case and for the conscientious examination which he had made. Truly the problem which presents itself to a child with glioma is very serious. Moreover the loss of sight becomes secondary to the peril of losing the child's life if appropriate measures are not rapidly instituted.

First of all, X-ray treatments should be tried, as Dr. Mario Esteban has well said, and the child should be watched so as to proceed immediately to enucleation, if necessary. Radiotherapy treatment ap-

pears to be always of some benefit. When the diagnosis is made early, good results can be obtained (Axenfeld). When the condition is already far advanced, it will prevent metastasis and provide better results after enucleation. The parents should be advised that glioma is congenital and that periodic examination of the eyes of the other children must be made in order to apply very early radiotherapy, if necessary. If the radiotherapy does not show any favorable results, enucleation of one eye or of both must be resorted to. If, as in this case, glioma is bilateral it certainly is terrible to tell the parents that enucleation is obligatory, but it is necessary to save the child's life. I am in complete agreement with Dr. Mario Esteban that there are no scientific, ethical, or social reasons for allowing the child to die. He may grow up to be a useful citizen and lead a happy and contented life.

ECTASIAS OF LACRIMAL SAC

DR. MARIN AMAT AND DR. MARIN ENCISO discussed the treatment of ectasias of the lacrimal sac by resection of the anterior wall, with presentation of patients. The immediate results are excellent. The operative technique is as follows:

1. Local anesthesia with 2-percent novocain in the same way as for dacryocystorhinostomy.

2. Curvilinear incision of the skin and superficial aponeurosis, identical with that which is in practice for dacryocystorhinostomy.

3. Separating with a blunt instrument the muscular fibers which cover the ectasia so as to expose the tendon of the orbicularis muscle and the anterior face of the lacrimal sac, so that it is freed from the surrounding tissues.

4. Sparing the tendon of the orbicularis, a portion of the anterior face of the sac is resected as much as is considered necessary by means of two slightly curvi-

linear anteroposterior incisions (the patient being in the horizontal position), by means of which the cavity of the sac is opened and its contents evacuated.

5. Introducing through the cavity into the nasal duct, whether this is open or not, a thick lacrimal, olive-tipped probe (no. 5 or 6) in order to enlarge the duct, if it is open; or to perforate it, if it is obstructed.

6. Suturing the lips over the resected part of the anterior wall of the sac with silk. The sutures should be somewhat thick and resistant in order that they can be easily removed. We use a continuous suture leaving the ends a little long in order to pass the upper thread under the lower border of the tendon of the orbicularis and take it out through the skin about 1 cm. from the wound, and we tie it to a rosary bead. We then tighten the silk suture and take it also through the skin about 1 cm. from the wound and tie it in the same way to another rosary bead. In this way, drawing on the silk sutures raises the anterior wall of the sac.

7. Suturing the skin by interrupted sutures.

8. If there is no communication between the inferior lacrimal canaliculus and the lacrimal sac, we reestablish it.

9. The lacrimal sac is washed with sterile water in order to clean out the small amount of blood that might stay there and to make sure that the passages are all clear. Generally we do this step as soon as we have made the deep suture and with the cutaneous wound still open so that we are in a position to introduce modifications which may be necessary.

10. Place a sterile piece of gauze on the operated region, and fasten it with a strip of adhesive.

Discussion. Dr. Carreras said that he wished to congratulate the authors of this interesting communication on this procedure if it gives such good results as ap-

pears from the small number of cases treated by them. This will solve a problem for which the only satisfactory solution so far has been dacryocystorhinostomy, which is a much more formidable procedure, and the results of which are less natural. However, we have to wait some time before accepting the new method, because, more than for the immediate results, we must watch for the final and permanent results. It is well known that probings will solve for a time the problem of epiphora, but that later the condition returns slowly and progressively, and the passages which were forcibly opened by probing close again. I, myself, had occasion to attend patients in the beginning of my professional career in Gerona, who had been treated by probings by my late father and who were dismissed as cured because the epiphora had ceased; yet that did not prevent the epiphora from recurring after a variable time. It is, therefore, desirable that the successes obtained by Drs. Marin Amat and Marin Enciso be confirmed by a large experience to which I expect to contribute with the cases which I have.

Dr. Galindez Rivero congratulated Drs. Marin Amat and Marin Enciso on their interesting presentation. He said the method is original, is simple, traumatizes little, and, in the cases for which it is indicated, provides ideal treatment for this affection of the lacrimal passages. That is, it cures the ectasia of the lacrimal sac and restores the normal course of the tears, eliminating epiphora—a condition which is a nightmare to both patient and doctor—and does it in a manner which is simple, gentle, and accessible to everybody.

I promise to apply the procedure of Drs. Marin Amat and Marin Enciso in suitable cases and report on the results obtained.

Joseph I. Pascal,
Translator.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

April 18, 1946

DR. BURTON CHANCE, *chairman*

A CASE OF STEVENS-JOHNSON DISEASE

DR. BRUCE A. GROVE and DR. EDMUND MEISENHOLDER (by invitation) said that Stevens-Johnson disease is generally considered to be a manifestation of erythema exudativum multiforme first described as a clinical entity by Von Hebra in 1866. The lesions occur in the conjunctiva as well as on the mucous membranes of the mouth, nose, pharynx, larynx, trachea, bronchus, and genitalia. Conjunctivitis may be the first symptom of the general disease, and according to Duke-Elder may take three forms: namely, a relatively mild catarrhal, a purulent, or a severe pseudomembranous affection.

The first recorded case of ocular involvement was described by Fuchs in 1876 as "herpes iris conjunctivae." From cultures reported, staphylococcus aureus is more commonly found than any other organism. The disease is of sudden onset with high fever and marked constitutional symptoms which gradually subside. The patient usually recovers in about 18 to 21 days. Although the prostration is severe, the mortality rate is low, only four deaths having been reported.

A review of the literature illustrates the confusion existing among writers as to proper cataloging of the disease.

Case Report. A white man, aged 30 years, first complained of light hurting his eyes. Examination revealed mild injection of the palpebral and bulbar conjunctiva. Within 24 hours he was violently ill, and his temperature rose to 103.2° F. There was a skin rash consisting of macules, papules, and intracutaneous

vesicles. Involvement of all the mucous membranes and mucocutaneous junctions and severe pseudomembranous conjunctivitis were noted.

The patient was discharged on the 21st day following onset of the disease with no loss of visual acuity, slight symblepharon, marked scarring of the palpebral conjunctiva, and occlusion of all the puncta. Drug and serum reaction was ruled out as causative agents. Acute vitamin deficiency was suggested as a causative factor. The writers concluded that Stevens-Johnson disease is a severe form of erythema exudativum multiforme with involvement of the conjunctiva whether it be catarrhal, purulent, or pseudomembranous.

Discussion. Dr. John F. Wilson said that Stevens-Johnson disease is considered by many authorities to be erythema multiforme, and the slides which Dr. Grove showed very well demonstrate the extensiveness of involvement which may occur in this disease. Not only bullae were present, but there were in addition various other lesions on the skin; namely, macules, papules, and pustules. The disease, erythema multiforme, produces multiforme lesions, which involve any of the dermal areas or the mucous membranes. It is thought to be due to a virus, although the virus has never been demonstrated. It is possible in Dr. Grove's case that a dietary deficiency lowered the patient's resistance so that such a virus gained a foothold in the patient.

It is important to differentiate the changes in the eyes in this case from those occurring in pemphigus vulgaris. There are three outstanding characteristics seen in this patient which will differentiate his disease from the changes seen in pemphigus vulgaris. These are not directly relative to the ocular structures. First, as Dr. Grove mentioned, pemphigus is usually found in older patients. This patient is now 30 years of age. He was about 28-

years old at the time of the attack. Second, the onset of the disease, unlike pemphigus, was sudden and severe. Within 24 hours, this patient's disease had almost reached its peak, and from that time on it gradually improved. The third factor is that the course of the disease lasted a total of 19 days. Pemphigus, however, is characterized by a longer term with exacerbations and remissions, and ultimately a fatal outcome.

There is one special type of pemphigus that could most likely be confused with this type of disease, and that is pemphigus of the mucous membranes, or localized pemphigus. This type is characterized by outbreaks of bullae in various areas of the skin, but occurring only in involvements of small areas at a time. There are then relapses with similar small areas showing the involvement, but ultimately the reaction becomes generalized. All of the skin and mucous membranes are affected, and the disease terminates fatally. It has a chronic course.

As Dr. Grove mentioned, Duke-Elder in his conclusions includes in the eye involvement of erythema multiforme, three types: the catarrhal, purulent, and pseudomembranous stages. He believes, and I think most of us agree with him, that these are changes in degree rather than in type. In other words, the pseudomembranous type shows the most severe changes in erythema multiforme involving the ocular structures. That point is aptly demonstrated by the penile lesion in this case. It bears a very close relationship with the ocular lesion, and shows a similar bandlike scar holding down the prepuce to the glans.

Dr. W. Zentmayer said that he did not wish to discuss the paper itself, but that he wanted to speak about the title of the paper. This was no criticism of the authors, because they have a precedent for the titles they use. When a general disease commonly has eye complications, it would

seem a questionable procedure to make an entity out of cases that happen to have eye complications that are a little more severe. By the same token, one might just as well speak of the Wheeler syndrome, because Wheeler's case was much more severe, developing panophthalmitis with loss of the eye. It would seem that it is pretty difficult to make out an entity for this group of cases of erythema exudativum multiforme. Furthermore, there is objection to using authors' names to designate a syndrome. The title gives no indication as to the subject matter of the paper. If one wants to search the literature for a certain condition, he may overlook cases that are published as an author-named syndrome.

Dr. Burton Chance said that he agreed with Dr. Zentmayer. It is quite difficult to know exactly to what the names of those two gentlemen might refer. The title would have been understood if it had denoted a special type of multiforme erythema.

ACQUIRED OPHTHALMIC ALLERGY

MAJOR WILLIAM F. BONNER (MC), A.U.S. (by invitation) discussed this subject. He said:

1. Acquired allergy may be single or multiple.

2. The most common offender is atropine, which may cause dermatitis and intraocular hemorrhage.

3. Quinine amblyopia may be acquired, and the one case reported was helped by 50,000 units of vitamin A, three times daily.

4. Hemorrhagic allergy was improved by padutin.

KERATITIS ASSOCIATED WITH LYMPHOGRANULOMA VENEREUM

DR. HAROLD G. SCHEIE and DR. ALAN S. CRANDALL (by invitation) discussed four patients who had identical corneal lesions of a distinctive type associated

with lymphogranuloma venereum. Evidence supporting the designation of the lymphogranuloma-venereum virus as the etiologic agent was considerable. (1) The corneal lesion was so characteristic as to suggest the diagnosis of lymphogranuloma venereum in all of these patients. (2) Diagnosis of the systemic disease was further established by additional clinical or laboratory evidence or both. (All had positive Frei tests. Two had scars of healed bubos and one had active inguinal involvement. The fourth patient showed no other clinical evidence of lymphogranuloma venereum, but did exhibit a strongly positive complement-fixation test, and a biopsy of the corneal lesion showed histologic changes compatible with the disease.) (3) The corneal lesion was always found associated with a positive Frei test and never with any disease other than lymphogranuloma venereum. (4) The lesions were identical with those occurring in a patient having lymphogranuloma venereum reported by Meyer and Reber in 1940.

Discussion. Dr. Henle said that they had had the opportunity to study in the laboratory one of the cases Dr. Scheie had just presented. The results obtained, thus far, served well to demonstrate the possibilities as well as the limitations of a diagnostic laboratory for virus infections. There are three general approaches to the laboratory diagnosis of a virus disease:

1. The isolation and identification of the causative agent.

2. The determination of the serologic response in the patient.

3. The demonstration of characteristic pathologic lesions.

All three approaches were used in this case. In discussing it, he would like to begin with the third approach, the demonstration of characteristic lesions. Part of the material obtained by biopsy from the cornea was sectioned and stained with Giemsa's stain. On examination many

epithelial cells were found and, in some regions of the section, practically all of them contained cytoplasmic inclusions. These consisted of aggregations of small, round bodies staining dark purple. In many places, individual or small groups of these particles were found. They had a diameter of between 200 and 300 μ , and probably represented the elementary bodies of the virus involved in this case. In lymphogranuloma venereum, such inclusions were first fully described by Miyagawa as granulo-corporules.

The serologic studies were likewise in accord with what one would expect to find. The complement fixation test with lygranum antigen (Squibb) was high, giving a serum antibody titer of 1:256. The antigen used was the same as that employed for the Frei test, which also was positive as Dr. Scheie pointed out.

As for the isolation of the causative agent, studies were not completed, as yet. The number of elementary bodies visible in the section would imply that the virus should be isolated with ease. On the other hand, the high antibody level in the patient's serum may cause considerable difficulties. In order to release the virus from the cells, the tissues have to be emulsified by grinding in a mortar with an abrasive, and it is impossible to avoid the contact of antibody with the virus; thus, some virus may be neutralized before the injection of the emulsion into experimental animals.

The first attempt at isolation of the virus was made by intracerebral injection of white mice. They developed no lesions. On the 12th day they were killed and their brains, after emulsification, passed to new mice. Again no lesions developed, and this line was discontinued.

A second attempt was made in the chick embryo. In this case the remaining material from the biopsy, which had been kept at -10°C ., was injected into the yolk sac of eight-day-old chick embryos.

They survived eight days of further incubation when the yolk sacs were harvested. A 20-percent suspension was passed to new eggs and also to white mice by the intracerebral route. These mice showed some signs of cerebral lesions on the fourth and fifth day. They lost weight, and on suspension by their tails they exhibited tremor, and on release had difficulties in regaining equilibrium. Passage of the brains from these mice to other mice produced severer lesions and death. As can be seen, there is a chance that the agent has been isolated from the biopsy material. If so, it has to be identified by neutralization of the agent with known specific immune sera as well as with the patient's serum. The possibility of having activated a latent virus in the mice has to be excluded.

What do the various data imply? The virus of lymphogranuloma venereum belongs to a group of agents which have been classed together on account of various properties they have in common. In this group of agents we find, besides the lymphogranuloma-venereum virus, the agents of psittacosis, ornithosis, meningo-pneumonitis, trachoma, inclusion blenor-rhea, mouse pneumonitis, and others. They all form similar cytoplasmic inclusions and exhibit serologic cross-reactivities. Neutralization of the toxic activity of these agents, described by Rake and Jones, constitutes the most specific test and serves best to differentiate between the various viruses of this group.

From the data presented, there is little doubt that the agent involved in the presented case belongs to this group of viruses, but we cannot say as yet with definite assurance that it is a strain of lymphogranuloma-venereum virus. Although all results seem to be in accord with this diagnosis, a differentiation between the various inclusions cannot be made with sufficient accuracy. The high complement-fixation titer with lygranum

antigen appears quite significant, but may not be out of the range of cross-reactions observed with some of the other viruses of this group of agents. Fairly strong cross-reactions with lygranum antigen have been reported, for instance, with serum from cases of psittacosis and of pneumonitis. The Frei test, too, has been found weakly positive in some cases of psittacosis, meningo-pneumonitis and atypical pneumonia. The final diagnosis hinges on the isolation and characterization of the causative agent.

Dr. I. S. Tassman said that he would like to ask Dr. Scheie whether he observed the characteristic conjunctival lesion in any of these cases of lymphogranuloma venereum. He believes that the typical lesion occurs on the conjunctiva in this disease, and it seems unusual for keratitis to occur as a manifestation of this condition. Can Dr. Scheie tell just what it was that made him recognize this form of keratitis as typical or characteristic of lymphogranuloma venereum?

Dr. Tassman had recently observed two cases similar to the ones described. These cases cleared up under treatment with sulfa drugs, and a third case improved with penicillin treatment. There was no clinical evidence of lymphogranuloma venereum present in any, although laboratory tests were not made.

As was pointed out by Dr. Henle, there are several other conditions in which the Frei test may be positive. It does seem that Dr. Scheie's case in which the laboratory findings were positive can be accepted as a real case of lymphogranuloma venereum. In the others, however, the diagnosis would be a presumptive one.

Dr. Warren S. Reese asked whether this lesion had any resemblance to the so-called salmon patch seen in interstitial keratitis.

Dr. George F. J. Kelly asked: Does sulphonamide therapy alter the findings of subsequent Frei tests? The recurrences

that were reported in two cases were thought to be due to inadequate treatment. Is there any known standard of treatment to prevent recurrences?

Dr. Alan S. Crandall said that it might be interesting to mention how the presumptive diagnosis was made in the last case. The patient had been seen several times, and lymphogranuloma venereum was not suspected. While the case was being studied, it was compared with a picture which Dr. Scheie had brought back from India. This picture showed keratitis in a patient diagnosed as having lymphogranuloma venereum. The similarity of the lesions was so striking that an immediate study of the patient was made with this disease in mind.

From the study of these few cases, Dr. Crandall believes that the lesion is characteristic of lymphogranuloma venereum. However, by the time the lesion becomes typical, there is permanent corneal damage. There will be some scarring and vascularization. It would be well if the index of suspicion were high enough so that the patient could be treated adequately before permanent damage occurs. It is important to reiterate the need for continuous treatment for a period of at least three weeks. The two patients who did not do well did not keep up adequate therapy.

Dr. Harold G. Scheie (closing) said that he believed there was little question that the lesion discussed was primarily a keratitis rather than a conjunctivitis. In the one case seen early, the onset was associated with symptoms of conjunctivitis, but promptly the corneal lesion appeared. All of the patients herein discussed, as well as the one of Meyer and Reber, seemed to show only secondary injection of the conjunctiva. There were no granulating lesions on the conjunctiva, and adenopathy was not observed.

The appearance of the corneal lesion seems characteristic and specific for the

disease. Most important is the slitlamp examination. The involvement of the cornea is through its entire depth. The lesion first appears within the upper limbus. Two of these patients subsequently developed a similar corneal infiltrate within the lower limbus, which also became vascularized. The vascularization seems quite characteristic. The vessels are all superficial and resemble an epaulette extending onto the cornea from the upper limbus, elevating its surface. The vascularized area does not stain. The lower border of the vascularized area is very sharply delimited; no isolated vessels grow into the infiltrate in front of the vascularized zone.

The patient first seen in the clinic of the Hospital of the University of Pennsylvania by Dr. Crandall was seen and discussed at one of the weekly conferences. The final conclusion reached by the staff members was that, because of the new vessels and the elevation of the surface of the cornea, neoplasm had definitely to be excluded as a diagnostic possibility.

Dr. Reese asked what resemblance these vessels had to the salmon patch of interstitial keratitis. The vessels in keratitis associated with lymphogranuloma venereum are superficial rather than deep as in interstitial keratitis.

Dr. Kelly asked about the effect of sulfonamide on the Frei test. It has none, and the Frei test remains positive for life. This explains why the Frei test can be confusing, and the diagnosis of lymphogranuloma venereum as the cause of any lesion must remain presumptive until the virus can be recovered.

The fourth patient presented was the most conclusive case. She had a positive Frei test, and, in addition, a very strongly positive complement-fixation reaction. A biopsy of the corneal lesion showed changes compatible with a diagnosis of lymphogranuloma venereum and now the virus inoculations seem to be showing positive results.

Finally, none of us has seen this corneal lesion in any patient not showing at least a positive Frei test for lymphogranuloma venereum. Even so, the diagnosis is presumptive at this point.

PIGMENTED NEVUS OF THE IRIS TREATED BY IRIDECTOMY

DR. JAMES S. SHIPMAN and DR. ROBB McDONALD presented a white woman, aged 59 years, who had had a spot on the iris of the left eye for as long as she could remember. Recently she had noticed that it had increased slightly in size. A tumor was noted in the lower temporal quadrant of the left iris, extending from about 1 mm. from the pupillary margin to the iridocorneal angle. The ciliary body was not involved. The tumor was removed by iridectomy, both operation and convalescence being uneventful. A diagnosis of leiomyoma was made by Dr. DeLong, and of nevus by Dr. A. B. Reese. Dr. Reese stated that this was a true nevus of the iris because nevus cells were present.

The tumor was completely removed at the time of operation. When the patient was last seen, vision in the left eye was correctable to 6/6.

Discussion. Dr. Perce DeLong said that the tumor under question had been submitted to many pathologists, and varied diagnoses were obtained. Some pathologists expressed belief that it was of a malignant nature. Others said that it was a nevus in an unusual location in the iris. Others agreed that it was a myoma.

Nevae usually grow from the anterior surface of the iris. This neoplasm arose from the substructure. It is quite unusual for a nevus to develop from this location.

The microscopic picture showed no special arrangement of cells; that is, there were no alveolar arrangements of cells commonly spoken of as nevoid bodies, nor did it contain epithelioid cells—both so

common in nevi. Instead, the cells were arranged in whorls. They were long, spindle cells and possessed many fibrils. Also, with the phosphotungstic-acid stain, the nuclei showed acidophilic reaction, a characteristic so common of myomas. For this reason Dr. DeLong felt that they were dealing with this type of neoplasm.

Dr. W. Zentmayer said that in one of two cases he had treated, the same difference of opinion existed among pathologists. The boy had had a fleshy looking growth of the iris, which was removed after the technique described in the case just reported.

The diagnosis of the first pathologist to examine the growth was leukosarcoma. He submitted it to a second pathologist who made a diagnosis of leiomyoma. Because of this difference of opinion, it was examined by a third pathologist who confirmed the diagnosis of the first pathologist. It was later studied by Colonel Ash who agreed with the second pathologist that it was a leiomyoma.

Dr. W. E. Fry said that he had had the opportunity to see this patient at the time of operation as well as to view the slides after the section was prepared. The case was somewhat similar to one which had been seen previously by him and by Dr. Adler and by Dr. Waite. The chief difference was that in the case he saw a contact glass was useful to determine a free angle.

After viewing the slides of the case presented by Dr. Shipman and Dr. McDonald, and after talking to both Dr. DeLong and Dr. Reese, he thought there were reasons for differing opinions. There could be some controversy in regard to the cells the slides showed. He believed this was a tumor in which the pigment-bearing cells were important, a malignant melanoma. Certainly the treatment of the patient was correct.

Dr. Burton Chance said that Dr. Zentmayer's case had certain aspects which

were quite like those in one of his patients. The tumor was removed in a manner similar to that described by Dr. McDonald. The man had received a number of different diagnoses. For five years, there had been a gradual, yet appreciable, growth of the tumor. It proved to be a mixed-cell sarcoma. The patient had insisted that the eye be removed immediately if the mass were malignant, and he had assumed the burden of the decision. With the assent of Drs. Posey and Madison Taylor, an otherwise perfectly healthy eye was excised. That was 20-odd years ago. Recently Dr. Chance had learned that the patient had been in perfect health ever since the operation.

Dr. Edmund B. Spaeth said that he had never seen a more beautiful photograph of an eye than the one showed by Dr. McDonald in his presentation. The photographs shown by Drs. Grove and Scheie in their presentations were also excellent. Presentations like these show the value of good photography in recording pathologic conditions.

Dr. James S. Shipman (closing) said that no less an authority than Duke-Elder states that at the present time our ideas as to the nature and classification of neurectodermal tumors are somewhat in a state of flux. It was not until 1910 that Verocay showed that these tumors were derived from a proliferation of the cells of the sheath of Schwann, indicating that they were of ectodermal origin.

Masson, 1926 to 1932, confirmed this opinion and more or less revolutionized all previous conceptions of neuroneoplasms. His researches were also confirmed by Stewart and Copeland, 1931; Foot, 1932; and others. Masson showed that cutaneous nevi arose from a neoplastic proliferation of the specialized end organs of the cutaneous nerves; namely, the Meissner corpuscle in the derma, and the Merkel-Ranvier cells, and the chromatophore, which are special types of

cells in the basal layers of the epithelium.

As a result of this finding, according to Duke-Elder, it appears that a number of tumors which used to be described in the literature as neurofibroma, plexiform neuroma, ganglionic neuroma, nevus, melanoma, and some types of sarcoma are neurogenic in origin, the fundamental cell of origin being the cell of Schwann.

According to Duke-Elder and Algernon Reese, nevi usually occur in the skin, conjunctiva, or at the junction of these two, and they are neuro-epithelial in origin, springing from the end apparatus of the sensory nerves which may be pigmented or nonpigmented.

The term melanoma seems to have been rather loosely used to describe a pigmented tumor in any part of the body and has no real value so far as indicating the origin or malignancy of the tumor. As has been pointed out in the presentation of this case, a pigmented tumor may be congenitally present in an iris for many years with no evidence of growth or increase in size until suddenly, for some unknown reason, it takes on the characteristics of malignancy as evidenced by its increase in size and extension into the angle of the anterior chamber, giving rise to some increase in ocular tension.

Certainly these signs should always make one feel very suspicious of malignancy and advise surgery, such as was done in this case, with the hope of removing the tumor in its entirety before it has invaded too far into the angle of the anterior chamber.

This case demonstrates the necessity of careful observation. Dr. Roth, who saw this patient and referred her to me, is to be congratulated for his acumen and for his judgment as to the time for surgical intervention. I am indebted to him for having referred this patient to me. I am more indebted to Dr. Zentmayer who confirmed our opinion as to the operation to be performed, and, more than that, for

having shown me just how to do this operation. I had the pleasure of being his assistant at a similar operation for just such a tumor of the iris about 19 years ago when I was a resident at the Wills Hospital.

This case has been presented as a preliminary report with the hope of stimulating some discussion and interest in tumors of the iris. Dr. McDonald and I hope to give a more complete report of this case at a later date when a more definite diagnosis has been agreed upon.

George F. J. Kelly,
Clerk.

CHICAGO OPHTHALMOLOGICAL SOCIETY

March 18, 1946

PETER C. KRONFELD, *president*

CLINICAL PROGRAM

The Fundus Clinic at Cook County Hospital was presented. One hundred twenty-eight cases were shown, including 48 cases of vascular disorders and diabetic retinopathies, 14 cases of diseases of the optic-nerve head, 16 cases of specific retinal inflammatory lesions, and 18 cases of traumatic retinopathy. Nine cases of congenital fundus defects were also shown. The miscellaneous group included anemias and various blood dyscrasias with retinal pathology, as well as degenerative diseases of the retina.

GLAUCOMA FOLLOWING INTRACAPSULAR CATARACT OPERATIONS

DR. IRVING PUNTENNEY presented this subject, an abstract of which follows.

The incidence of glaucoma following extracapsular cataract varies. Most observers attribute this type of glaucoma to obstruction of the filtration angle. A comparison of the incidence of glaucoma fol-

lowing intracapsular cataract extractions shows an advantage in favor of the intracapsular extraction. Glaucoma, when it occurs, is often the end result of certain anatomic changes which have been brought about during the course of the operation. During the last two years 16 cases of glaucoma were studied and treated. The glaucoma followed Verhoeff intracapsular extractions. No mathematical figures can be given as to incidence, because the operations were not performed by the author. Analysis of the findings in uncomplicated extractions, however, reveals that approximately 65 percent of the patients had mushrooming of the vitreous, together with adhesions of the iris pillars to the corneal incision. This was usually associated with peripheral anterior synechiae. Delayed reformation of the anterior chamber occurred in approximately 33 percent of the cases, and an equal number had an iris collar. A study of the findings in the complicated extractions showed that all patients had vitreous in the anterior chamber, with adhesions of the iris and iris pillars to the cornea. Vitreous was adherent to the incision in 75 percent of patients. An iris collar was present in 25 percent, and iris prolapse occurred in 50 percent.

In general, most cases of glaucoma appeared to result from complications which occurred during or following delivery of the lens. It is possible that preoperative gonioscopy would have revealed peripheral anterior synechiae in a large number of these patients but, nevertheless, the precipitating factor seemed to be a shift in the position of the vitreous with mushrooming of the vitreous into the pupil, formation of anterior peripheral synechiae; adhesion between the iris columns and the cornea, adhesions between the vitreous and the cornea, the presence of an iris collar, and iris or vitreous prolapse.

Prevention of this type of secondary glaucoma depends upon four factors:

1. Ability of the operator to remove the lens without disturbing the vitreous.
2. Maintenance of the normal position of vitreous and iris.
3. Early restoration of the anterior chamber.
4. Elimination of an iris collar at the base of the iridectomy.

Discussion. Dr. Bertha A. Klien spoke of the emphasis placed by Dr. Puntteney on the prominent role of the vitreous in the pathogenesis of certain types of secondary glaucoma, and showed slides to illustrate some of the consequences of dislocation of the vitreous; that is, a herniation or prolapse into the anterior chamber or an incarceration into a penetrating scar. In many histologic preparations it is seen that, driven out of its normal habitat, the vitreous stimulates growth of certain cells of the tissues of its new surroundings. Dislocated vitreous may be covered gradually by corneal endothelium and new Descemet's membrane. It may be invaded by newly formed keratoblasts, which gradually solidify strands of vitreous by production of a substance similar to corneal parenchyma. Herniating or prolapsed vitreous may become rapidly anchored to the anterior surface of the iris by proliferation over it of the anterior border-layer endothelium, producing occasionally occlusion of the pupil or, in the case of a coexisting hemorrhage, by formation of a network of phagocytic wandering cells, which are deposited on its surface and gradually take on the appearance of fibroblasts.

Membranes formed by growth of such a variety of cells over and into the vitreous gradually shrink and may thus dislocate the vitreous still further and, in this way, perhaps exert traction upon portions of the ciliary body and produce a rise of tension by irritation of the ciliary processes.

It would be interesting to know

whether cyclodiathermy, which would be the operation of choice in such a condition, has proved to be especially successful in the treatment of secondary glaucoma after intracapsular lens extraction with damage to the vitreous.

Dr. William F. Moncreiff said that, for a round-pupil extraction, three corneoscleral sutures are of great value for the prevention of iris prolapse. Three mattress sutures are equivalent to six sutures, the wound is airtight and the anterior chamber can be immediately restored by filling it with an air bubble. Remnants of the air bubble may remain even for four days when the chamber has been well-filled. To avoid a shift in the position of the vitreous toward the wound, one must rely on retrobulbar injections to reduce the tension, avoidance of undue pressure on the eyeball, and, of course, the proper handling of the eye in all respects.

If the extraction is performed properly, the vitreous should not suffer any disturbance unless it is adherent to the lens, which is quite an uncommon condition. If fine sutures (0.004 or 6.0) are used, it will be found that one, two, or even three of the sutures when properly tied will cut out spontaneously on the corneal side within a week or two.

Dr. H. Saul Sugar emphasized the role of delayed reformation of the anterior chamber after extraction from the point-of-view of the gonioscope, by means of which the main factor of the formation of peripheral anterior synechiae has been observable. The vitreous is much more easily visualized gonioscopically when present in the chamber than one would imagine. Three things might be done to prevent glaucoma after cataract extraction, intracapsular or extracapsular. The round pupil has advantages particularly after intracapsular extraction. The use of eserine after operation keeps the angle of the anterior chamber open. It also has a

tendency to limit mushrooming of vitreous into the anterior chamber. In addition, corneoscleral sutures, plus filling the anterior chamber with bubbles of air, will aid in preventing this type of glaucoma.

Dr. Thomas D. Allen congratulated Dr. Puntenney on this excellent presentation, and felt that Dr. Klien's pictures were extraordinarily illuminating. He favored the use of the tonometer routinely in pre-operative study. Following instillation of homatropine, the use of the tonometer shows what dilation of the pupil has done to the eye and may show the possibility of glaucoma. He agreed on the advisability of waiting four days postoperatively before dressing the eye, and was quite convinced that much less postoperative glaucoma ensued if nature were allowed to take its course. Allen Greenwood said, some years ago, that anterior peripheral adhesions were due to incorrect use of the iris spatula in the postoperative toilet of the wound, that sometimes the back of the cornea was touched, and cells detached from Descemet's membrane, so that when the wound is closed, the iris is likely to become adherent. Insertion of air into the anterior chamber aids in replacing the iris, but Dr. Allen had the feeling that it might act as a foreign body.

Dr. Louis Bothman mentioned that often posterior synechiae occur after cataract operation without glaucoma. He wondered if Dr. Puntenney had any figures on the percentage of cases with glaucoma as compared with those which have synechiae without glaucoma.

Dr. Erwin E. Grossman recalled a study, made several years ago with Dr. Kronfeld, on the role of peripheral anterior synechiae in connection with glaucoma in aphakic cases. He felt that this study gave overwhelming evidence that the main cause of glaucoma was synechiae. In the cases of glaucoma without anterior synechiae, other causes were

found. Iritis was one of these causes.

In the cases of glaucoma with synechiae, the degree of glaucoma varied with the extent of the synechiae. Those cases that had glaucoma and no anterior synechiae seemed to respond very well to medication; whereas, those with extensive synechiae usually went on to surgery. More than 100 cases were included in the study.

Dr. Peter C. Kronfeld emphasized what Dr. Sugar and Dr. Grossmann said. The paper of Drs. Grossmann and Kronfeld (*American Academy of Ophthalmology and Otolaryngology*, 1941) showed a definite quantitative relationship between the extent of the anterior synechiae and the incidence and severity of glaucoma. Mushrooming of the vitreous into the anterior chamber is very common in aphakic eyes that do not have glaucoma. So far as Dr. Kronfeld could determine, corneoscleral sutures, which in principle consist of horizontal bites, should be named after Liegard and not after Kalt.

Dr. Irving Puntenney (closing) thanked Dr. Klien for her interesting and scholarly discussion. He was pleased to hear Dr. Moncreiff discuss the value of introducing air into the anterior chamber. He doubted that it acted as a foreign body and believed it could do no harm unless bacteria were introduced at the same time. Some men prefer to fill the syringe by sucking the air through moist gauze. The gauze is not a very efficient filter but may help to eliminate airborne bacteria.

It is necessary for the operator to be able to pull up the corneoscleral suture immediately after delivery of the lens. The technique described was used as a routine measure by Dr. Sanford Gifford, and many cases have been seen where speedy closure of the wound prevented vitreous loss.

Dr. Sugar's discussion was also appreciated, and the recent work of Sugar,

Kronfeld, and Gradle gives far more information on the subject than this paper. In response to Dr. Allen, the use of the tonometer should be stressed in recording intraocular pressure. It is a mistake to rely on tactile pressure and, if this is done, numerous glaucoma cases will not be diagnosed until field defects are present. It is not necessary to postpone routine eye dressings until the third or fourth day, unless the patient is apprehensive or there is a tendency to vitreous prolapse.

In answer to Dr. Bothman, no percentage can be given because gonioscopy was not done in all cases. However, the answer could be found in Dr. Kronfeld's work. The present study could not be carefully controlled; the findings herein discussed were readily seen not only with the gonioscope but also with the slitlamp.

MODIFICATION OF CATARACT DISCUSSION IN THE PRESCHOOL AGE GROUP

DR. WILLIAM F. MONCREIFF presented a paper on this subject which was published in this JOURNAL, December, 1946, volume 29, page 1513.

Discussion. Dr. James E. Lebensohn said that cataract before the age of six years, in what Dr. Moncreiff aptly terms the preschool group, can be considered a rather definite clinical division since all forms of cataract within this period characteristically have but a slightly differentiated and unresisting nucleus. He had observed some of Dr. Moncreiff's cases and was impressed by the results. The operative management has certain essential features:

1. Both eyes are operated on at the same sitting, if the condition is bilateral. Considering the slight risk involved this procedure is logical, as it minimizes hospitalization and promotes binocular vision.

2. Maximal mydriasis is maintained both before and after operation. In preoperative preparation it must be empha-

sized that only spastic mydriatics, such as 10-percent neosynephrin or 1- to 2-percent adrenalin, ensure full dilation of the pupil after loss of aqueous.

3. A wide opening of the capsule is accompanied by thorough fragmentation of the lens, avoiding, however, entry into the vitreous. Before spastic mydriatics were introduced in ocular surgery a similar method was practiced by Emmert in 1903, but because of increasing tension, a linear extraction regularly followed 24 hours later. Dr. Moncreiff reasons that the mechanics of such tension rise is associated with swollen lens substance trapped behind the iris and claims that, with his technique, this complication is adequately avoided.

4. Some aqueous is allowed to escape. This step, which was not permissible when atropine was the only mydriatic available, is physiologically sound, as the plasmoid aqueous which follows has a much higher content of proteolytic enzymes.

5. The last detail is irrigation of the anterior chamber to displace lenticular remnants from the capsular sac. In Morgagnian cataract, it is generally agreed that the milky-white fluid released by discission must be immediately evacuated. Does Dr. Moncreiff find his simple irrigation adequate in such cases, or must the discission wound be enlarged?

Few surgeons doubt the desirability of leaving the vitreous untouched. A coating of vitreous probably delays the absorption of lens matter. Even worse, after the discission needle penetrates the vitreous, a fine thread of the humor is almost invariably carried back to the wound. Infection may thus gain entrance, or later retinal detachment may follow from adhesion of vitreous to the corneal scar.

Dr. Moncreiff regards about one year as the youngest age suitable for operation because only then can the pupil of the eye be adequately dilated. In this he is in

practical agreement with Treacher Collins, who concluded, because of other structural features, that 10 months should be the minimal age.

Other details of the discission operation are worthy of attention. As Jackson maintained, it is safer to introduce the needle through the vascular limbus than through the clear cornea. As a further precaution, Herbert provides the wound with a covering by sliding the mobile conjunctiva to the point of puncture.

The surgery of soft cataracts has a long and dramatic history. Percival Pott, in 1775, was the first to propose laceration of the capsule as a distinctive method. About 30 years later, Saunders demonstrated its value in children, and his first report listed results on 14 persons born blind, one of whom was only two months old. In the years since, many patients have been acutely troubled by strings attached to the gift of sight, strings of vitreous, capsule, and lenticular debris. Dr. Moncreiff has tackled the problem with insight. His solution deserves the earnest consideration of all eye surgeons.

Dr. Glenn Harrison assumed that one inserts the irrigator through the same opening made by the knife-needle, and that the excess irrigating fluid would be expelled through this opening. Since the Ziegler knife-needle would have too long a blade to permit extensive manipulation inside the anterior chamber, does Dr. Moncreiff use a special knife-needle?

Dr. Peter C. Kronfeld said that the procedure advocated and practiced by Dr. Moncreiff may be described as maximum comminution of the lens by multiple incisions and dislodgement of the comminuted material into the anterior chamber by irrigation, both procedures being accomplished through a minimal opening in the eyeball wall.

Multiple, but not through-and-through incisions of the lens, were advocated by Straub. Intentional dislodgement of lens

material or, more specifically, the nucleus into the anterior chamber for the purpose of comminution, was practiced by Krueckmann. To use irrigation for this purpose is Dr. Moncreiff's original and valuable contribution.

While his series of cases is small, it is remarkable that he obtained optically satisfactory conditions with just one operation in six consecutive eyes. A larger series of cases will be necessary to prove that the dislodgement of the lens material from behind the iris into the anterior chamber constitutes an antiglaucomatous factor. In Dr. Falls's series, glaucoma occurred only in 8 percent of the operated eyes. There is no definite concept concerning the mechanism of such glaucomas. Even though most of the anterior chamber may be filled with fluffy lens matter in these cases, it is highly probable that the upper half of the angle is open and functioning. Thus, the concept of angle obstruction by lens material in the anterior chamber is probably too diagrammatic.

With regard to the work of the other authors mentioned by Dr. Moncreiff, Dr. Falls has said that the procedure at the University Hospital of the University of Michigan has been "rather deep incisions with rather deep vigorous stirring of the cortex of the lens."

It was Dr. Kronfeld's feeling that Ziegler's through-and-through needling operation had been abandoned, and that Dr. Moncreiff's criticism of the procedure was, therefore, rather unnecessary. Dr. E. B. Spaeth of Philadelphia, however, stated that there are still people who practice the Ziegler through-and-through needling operation. Dr. Spaeth, himself, considers it an obsolete and dangerous procedure (personal communication). Dr. Kronfeld was in agreement with Dr. Moncreiff and Dr. Spaeth in that (1) interference with the anterior vitreous should be avoided whenever possible and

(2) through-and-through incisions of the lens offer no advantages so far as comminution and absorption of the lens material is concerned. There is definite hope that Dr. Moncreiff's procedure will simplify the treatment of congenital cataract.

Dr. William F. Moncreiff (in closing) said, in reply to Dr. Harrison, that the knife-needle has a blade of which the sharp edge is practically straight, and is about 2.75 mm.; or at most 3 mm., in length. Concerning escape of fluid, the shaft of the knife-needle should fill the incision and prevent loss of the anterior chamber during the entire dissection part of the procedure. Should aqueous be lost inadvertently, the chamber can be filled with the irrigator, and the knife-needle reinserted. Introduction of the tip of the irrigator two or three times is not likely to cause infection, and the routine use of penicillin as a prophylactic is neither desirable nor necessary.

It is common knowledge that lens substance absorbs most rapidly and completely when free in the anterior chamber, and free from any enclosure in the capsule. This is often seen, particularly in those cases where more than the usual amount of cortex remains after extracapsular extraction. It was seen more frequently in former times when irrigation of the anterior chamber was not routine in the extracapsular extraction. As Dr. Levensohn said, Percival Pott, almost 200 years ago, attempted in the dissection of congenital cataract to dislocate some of the lens substance into the anterior chamber with the knife needle. Obviously, the method described here was arrived at quite independently. As to the Ziegler operation, it is true that most good eye surgeons consider it dangerous, but it is currently used and endorsed, if not actually defended, by two very prominent eye surgeons, one of whom is still quite active.

Richard C. Gamble,
Secretary.

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BIOGENIC STIMULATORS

Third Witch:

Scale of dragon, tooth of wolf
Witch's mummy, maw and gulf
Of the favin'd salt-sea shark,
Root of hemlock digg'd i' the dark,
Liver of blaspheming Jew,
Gall of goat, and slips of yew
Sliver'd in the moon's eclipse,
Nose of Turk, and Tartar's lips,
Finger* of birth-strangled babe,
Ditch-delivered by a drab,
Make the gruel thick and slab:

Add thereto a tiger's chaudron
For the ingredients of our cauldron.

All:

Double, double, toil and trouble;
Fire burn, and cauldron bubble.

Second Witch:

Cool it with a baboon's blood,
Then the charm is firm and good.

Macbeth, Act IV, Scene I.

The late Sanford Gifford said (*Hand-book of Ocular Therapeutics*): "The difficulty in estimating the value of

* Why not placenta?

therapeutic agents administered in an attempt to aid this mechanism (the defensive mechanism of the body) is, therefore, obvious. This explains the remarkable variance in reports of different observers and often of observers whose clinical judgment is usually very reliable, as to the effect of various therapeutic agents. A chance series of cases with a fortunate outcome may convert an ophthalmologist of unquestioned standing into an enthusiastic advocate of a measure which has little to recommend it theoretically, and which in the hands of other men may later prove absolutely worthless. Thus it is necessary to greet the first reports on the use of any new agent with a certain amount of reserve. Agents of recognized value should not be abandoned in favor of new ones unless the evidence in favor of a change is convincing. The evidence of a small number of case reports alone is apt to be unsatisfactory, and one will be slow to take up the use of a new method unless there exists a certain foundation of theoretical and experimental reasons why the new method is likely to prove of advantage."

The fundamental common sense in this thought of a great ophthalmologist bears repetition today, when one is bombarded by press releases of new and often astounding discoveries of cures in the medical sciences. The evils of premature, spectacular publicity are too well known to be discussed here, nor is it necessary to detail the harm done to the public, and eventually to the entire medical profession, by such propaganda, either willful or innocent. The history of medicine is filled with these false alarms that have misfired, or, what is less serious, backfired into the faces of those responsible. What we never discover is the total cost to the afflicted, either in mental distress engendered by their false hopes, or to their pocketbooks, which in our material-

istic age seems to be more important. What is morally worse, by far, is the example set to our younger men who see the leaders "getting away with it" and thus are inspired to imitation.

Elsewhere in this issue will be found an article by Dr. Dan M. Gordon on the "Treatment of Retinitis Pigmentosa with Special Reference to the Filatov Method." It will bear careful study, for it details the history of the flotsam and jetsam of the wrecks of ideas regarding the treatment of this disease. This paper reemphasizes what Duke-Elder has so ably expressed. "None of them (remedies for pigmentary degeneration of the retina), however, has shown anything approaching lasting or consistent results, and it is probable that the temporary improvement following many of them is due to an increase in the metabolic activity in the eye rather than to any specific action. In the assessment of all of them it is well to take into consideration the natural fluctuation in the progress of the disease, as well as the enthusiasm of the practitioner and the credulity or the desperate hopefulness of the patient."

One has no quarrel with Filatov and his co-workers over the attempt to treat this so far hopeless ocular condition by any means whatsoever, fantastic as those means may seem to us. The mysterious and at present unknown action of his "biogenic stimulators" requires investigations of the most rigid and controlled sort, before they can be hailed as the long sought philosopher's panacean stone of ocular therapeutics. The work of Gordon and others is an attempt to evaluate and clarify the premise of Filatov. It is necessary that such work be done, under most careful scientific scrutiny and in the Eye Institutes that are especially equipped to carry out such meticulous study.

It would seem, from a study of the available Russian literature, more or less

abstracted to be sure, that the tissue therapy of Filatov is a new way of introducing a foreign-protein reaction, although differing in some respects, perhaps, from such biogenic stimulators as milk, typhoid vaccine, and Coley's serum. A severe febrile reaction has been produced in a "moon-blind" horse by the injection of sterilized horse feces with some improvement of his periodic ophthalmia (author). Sterile abscesses have been created as biogenic stimulators by many means (seton, croton oil, cupping, sterile blood, and so forth) and "laudable pus" was celebrated a long time ago. In fact, the witches' brew of Shakespeare may well contain the pharmaceuticals we are looking for, if Filatov's work with offal is substantiated.

No, the quarrel is not with Filatov and his group, primitive and slightly obscene as his treatment may seem to be to us. It is with the noisy group of fellow travelers in this country who by aggressive publicity measures seek to promote this treatment in the press for political purposes. This is the true danger to science.

On April 28, 1946, the *New York Herald-Tribune* carried a descriptive announcement hailing in enthusiastic terms the Filatov method. The ophthalmologists of this country were besieged with requests by their patients, afflicted with retinitis pigmentosa, for this treatment. In a personal communication, Dr. Robert Leslie, business manager of the *American Review of Soviet Medicine*, stated that the American Society for Russian Relief issued this newspaper release to the press, which he had not authorized. However, in the June, 1946, issue of the *American Review of Soviet Medicine*, four out of the nine main articles were by Filatov, or Filatov and Verbitska, considering the treatment of retinitis pigmentosa and the fantastic results of their methods of treatment (85 successful re-

sults out of 110 cases). Dr. Leslie circularized the ophthalmologists of this country with letters calling attention to the articles and offering a copy of the issue for one dollar. The magazine *Newsweek* has carried several articles about this treatment, and not long ago a group was formed in New York, financed for the sole purpose of promoting and perhaps exploiting the Filatov treatment.

It is to the credit of American medicine that there has been no blind stampede into this grotesque field of therapeutics. Scientific work will rise or fall upon its own worth and integrity. Scientific truth will ultimately prevail and all the subversive trumpets in Christendom or in pagan countries cannot promote for long an issue that is basically unsound. They can only succeed in confusing us and hiding for a time fundamental errors. These noisy promoters often end up by mistreating the common man whom they pretend to protect and whose welfare they affect to coddle.

The danger to science of replacing the mortarboard by the pileus, the scarlet gown of the free doctor by the black shirt of Nazism or the red one of Communism, or by the star-studded hood of the necromancer, has been sadly demonstrated only too often in the past history of man's civilization. Politics and the state have no place in the premature exploitation of any medical discovery, regardless of the outcome.

Derrick Vail.

OPHTHALMOLOGICAL STUDY COUNCIL

The third and last of the Ophthalmological Study Council courses is to be given this summer in Portland, Maine. As is usual with the end approaching, the managers are just beginning to feel some confidence in their understanding and control of the problems raised by so

large an enterprise. So far as is known, this is the only attempt by any medical specialty to meet the needs of the five-year supply of prospective specialists with less than a one-year facility for training. These courses have turned out to be far more than a stop gap. They were outstanding among the very good courses given during the period. The instructors were picked from every part of the United States. Many of them were men with international reputations. The subjects covered were such as to give the students a more comprehensive training than the purely basic courses. Finally, by weekly examinations in the subjects under immediate consideration, an earnestness of application developed rarely seen in graduate study.

Examinations serve another important end. They rate the teacher quite as definitely as the student. If a few students fail in a course, the inference is that they can't or don't take in what the rest of the class are able to absorb. That is their fault. But if a large part of the class get "busted," that is an indication that the teaching was inadequate. The teacher is to blame.

The second Study Council course, given in St. Petersburg, Florida, in November and December, 1946, and part of January, 1947, profited by the criticisms of the Boston course made by the students. The physical arrangements were more convenient. The lectures were held in the same hotel that housed both faculty and students. Clinical demonstrations in refraction were included. In the curriculum changes were minor. The greatest difference was that the lecturers had their material better in hand.

To date approximately 150 applicants have taken the course at one or the other session. This leaves some 300 inquirers who have not been accommodated. While many of these may have given up speciali-

zation, other applications keep coming in. In one final attempt to accommodate all who need this instruction, the committee has made arrangements for a third and last session. It will be held during the coming summer, a time likely to be more convenient for both students and lecturers. It will be given in Portland, Maine, a resort center with an agreeable summer climate. The facilities of the Westbrook Junior College have been made available, affording housing, feeding, and classroom accommodations at far less cost than that of the previous sessions. Because of the general approval given the St. Petersburg course, no other important changes will be made. Faculty and curriculum will be essentially the same. The aim will be to prepare the students for preceptorships. If they have the good fortune to secure residencies, they will be better equipped to make use of these opportunities. Even inferior residencies will, therefore, become more useful.

With the completion of this session, ophthalmologists will have the satisfaction of knowing that their specialty alone has at least furnished an opportunity to many men who served their country at a large sacrifice and would not otherwise have ever had an opportunity to undertake proper training. At best it will have provided a creditable foundation for many ophthalmologists, at a time when there is a decided shortage of well-trained men.

S. Judd Beach.

THE PROCTOR RESEARCH MEDAL

The Association for Research in Ophthalmology has just announced a gift from Mrs. Francis I. Proctor of Santa Fe, New Mexico, for the endowment of a research medal in memory of her husband, to be awarded for outstanding research in the basic sciences as applied to

ophthalmology. Dr. Proctor was a Boston ophthalmologist who settled in Santa Fe after his retirement and became actively interested in experimental ophthalmology, particularly as applied to trachoma and other special disease problems of the American Indians. As Consultant on Ophthalmology to the Office of Indian Affairs, he induced Noguchi to undertake his investigations of trachoma which, although in themselves fruitless, inspired a series of researches by American and foreign workers which finally proved that the agent of trachoma is a virus belonging to the psittacosis-lymphogranuloma-venereum group of viruses. In view of Dr. Proctor's passionate interest in basic investigation and the help and stimulation he gave to it in his later years, it is particularly appropriate that this research medal be founded in his name.

The Proctor Medal will differ from the other medals in ophthalmology in being open to nonclinical workers in ophthalmology. There is an increasing number of basic-science workers attached to the large university eye clinics who will become eligible for it, as well as a smaller number who are not assigned to special eye departments but are doing their major research in basic eye anatomy, physiology, pathology, and so forth.

It is the intention of the association to award the Proctor Medal sparingly so as to insure its carrying distinction. At the same time, it will not be awarded so infrequently as to impair its value as a stimulus to basic research.

The Proctor Medal would appear to fulfill a definite need and should prove a fitting companion to the Howe Medals of the American Ophthalmological Society and the Section on Ophthalmology of the American Medical Association, and to the Knapp Medal of the Section.

Phillips Thygeson.

OBITUARY

SIR ARNOLD LAWSON

(1868-1947)

Sir Arnold Lawson, one of England's most widely known and best loved ophthalmologists, died on January 19, 1947, at the age of 79 years.

Following in the specialty of his distinguished father, George Lawson, surgeon-oculist to Queen Victoria, Arnold Lawson was educated at Taylors School in London and entered Middlesex Hospital as senior entrance scholar in 1886. He was qualified in 1891.

Sir Arnold served as clinical assistant to Sir John Tweedy at Moorfields, as ophthalmic surgeon to the Paddington Green Children's Hospital, and on the staff of Moorfields. In 1914, he became ophthalmic surgeon and lecturer on ophthalmology at Middlesex to whose staff he was appointed in 1910.

During the first world war, Sir Arnold resigned from all but the Middlesex appointment to devote himself to the blinded soldiers and sailors. It is for his work among these men at St. Dunstan's that he will be forever remembered. Hundreds of soldiers and sailors blinded either in World War I or II will miss his sympathetic understanding and kindly interest even more than they will miss the great knowledge and skill which he brought to the treatment of their blindness.

CORRESPONDENCE

ANGLE KAPPA IN STRABISMUS

For the accurate determination of the angle deviation in strabismus, when the latter is measured objectively on the perimeter, the value of the angle kappa has to be added to or subtracted from the value thus found. The angle kappa (often referred to as the angle gamma with which it is almost identical) is the angle between the visual axis and the pupillary

axis. The latter is the imaginary line through the center of the pupil, normal to the cornea. It is determined by the reflection in the center of the pupil of a small light held in front of the eye. Angle kappa is considered positive when the pupillary axis is temporal to the visual axis; it is considered negative when the pupillary axis is nasal to the visual axis.

Herewith is an easy way to remember when the angle kappa has to be added or subtracted in order to arrive at the true value of the angle of squint. The angle of deviation in convergent squint may be considered a positive angle and denoted by the plus sign. For convergence is a positive function and the angle of over-convergence may be thought of as a positive angle. Similarly, the angle of deviation in divergent squint may be considered as a negative angle and denoted by the minus sign. Divergence may well be thought of as a negative function; in fact, it is often referred to as negative convergence. Thus the angle of divergence from the point of fixation on the perimeter may be considered a negative angle.

If the angles are thought of in this way, all that is necessary is simply to add al-

gebraically the values of the angle kappa and the angle of squint. Thus if the squint angle in convergent squint measures 15 degrees, and the angle kappa is plus 4 degrees, the true angle of squint is plus 15 and plus 4 equals 19 degrees. If the angle kappa in this instance is minus 4 degrees, then plus 15 and minus 4 gives us 11 degrees as the true angle of squint.

Or, if the angle of squint in divergent strabismus measures 20 degrees, we then have an angle of minus 20 degrees. If the angle kappa is plus 5 degrees, we get minus 20 degrees and plus 5 degrees, which gives us minus 15 degrees as the true angle of the divergent squint. If the angle kappa in this instance is, say, minus 5 degrees, then adding minus 20 and minus 5 gives us minus 25 degrees as the true angle of the divergent squint.

This method of considering the deviation angle in convergent squint as positive and the deviation angle in divergent squint as negative and then merely adding the value of the angle kappa is generally easier than other methods designed as memory aids.

(Signed) Joseph I. Pascal,
New York, New York.

BOOK REVIEW

LES YEUX ET LA VISION DES VERTÉBRÉS. By A. Rochon-Duvigues and. 792 pages. Paris, Masson et Cie., 1943.

This volume presents an exposition of the comparative anatomy and comparative physiology of the eye that is considerably more extensive than would be possible in a zoological handbook. The morphology of the human eye occupies the first 150 pages. The chapter on the origin of the vertebrate eye outlines the contributions of paleontology, comparative anatomy, and comparative embryology. The

remainder of the book is a systematic exposition of the anatomy, histology, and the functions of the eye in each group of vertebrates. A chapter is devoted to the eyes of the cyclostomes, the several orders of fishes, the amphibians, the four orders of reptiles, the birds, and the mammals. Five hundred beautifully clear, half-tone illustrations, chiefly from histologic preparations, clarify the text instead of merely decorating it. They also decorate it. There is an adequate bibliography in each section.

F. H. Haessler.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

- | | |
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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

3

PHYSIOLOGIC OPTICS, REFRACTION AND COLOR VISION

v. Bahr, Gunnar. The effect of peripheral rays in testing the light sense. A study on the importance of the pupillary area. *Acta. Ophth.*, 1941, v. 19, pt. 2, pp. 114-123.

This study was done on eight medical students, using the Gullstrand photoöptometer. The patient's head was held in position by biting into a cast of his teeth that was attached to an arm on the Zeiss chin rest. The arrangement permitted illuminating the desired areas of the pupil with a 2-mm. pencil of light. The examinations showed that beams entering the pupil from the nasal field through the peripheral portion of the pupil have less stimulating effect than those which pass through central portions, and that the effectivity can decline by about 30 percent. With a dilated pupil the effective amount of light is therefore not in direct proportion to the size of the pupil, except in its central portion. The

data show that in light sense tests, which aim at discovering the function of the retina only the central pupillary area can be depended upon, and the pupil should be kept contracted with pilocarpine. (2 illustrations.)

Ray K. Daily.

DeVoe, A. G., and Dietz, V. H. Plastic visual test plates. *Amer. Jour. Ophth.*, 1947, v. 30, March, pp. 325-326. (1 figure, references.)

Heinonen, Oscar. Testing of color vision. *Acta Ophth.*, 1941, v. 19, pt. 2, pp. 109-113.

A candidate for railroad service was certified for normal color perception by one ophthalmologist, and was found color defective by another. The color perception of the mother was found defective. Inasmuch as all sons of a mother with defective color perception are color blind, the disagreement between the two ophthalmologists was decided by the findings on the mother.

Ray K. Daily.

Litinsky, G. A. **Fluctuating visual acuity.** *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 36-38.

In a 22-year-old man with unilateral traumatic cataract the vision in his good left eye was normal, when his face was turned to the left, and was reduced to 0.1 with the head in the normal position. Litinsky found that the patient had an old paresis of the left external rectus muscle, and the effort of the paretic externus to hold the eye straight produced a nystagmus, which reduced the visual acuity. When the patient's face was turned to the left, the nystagmus disappeared.

The second patient had a divergent strabismus; he could hold his eyes straight with great effort. Monocular visual acuity in each eye was normal. Binocular acuity was 0.1. This reduction is explained by an artificial myopia produced by the excessive accommodation that was associated with the exercise of strong convergence.

Ray K. Daily.

O'Brien, J. M., and Bannon, R. E. **Accommodative astigmatism.** *Amer. Jour. Ophth.*, 1947, v. 30, March, pp. 289-296. (2 figures, 4 tables, references.)

Pascal, J. I. **Cardinal points in aphakia.** *Arch. of Ophth.*, 1947, v. 37, Jan., pp. 83-84.

The author presents a diagram to aid in remembering the cardinal points of the eye in aphakia. R. W. Danielson.

Pascal, J. I. **Pressure effects in contact lenses.** *Amer. Jour. Ophth.*, 1937, v. 30, March, pp. 324-325.

Plicque, J. **Analysis of binocular vision. Part II, binocular synthesis.** *Ann. d'Ocul.*, 1946, v. 179, May, pp. 255-279.

The first part of this essay was re-

cently abstracted in this journal. Stereoscopic vision is an instantaneous phenomenon in which the sensorial factor dominates the muscular and in which the semiperipheral part of the retina is as important as the central part. In instantaneous perception the association centers add details to form a more or less complete mental picture which is of importance in the establishment of reading habits. Retinal correspondence is proved clinically and diplopia is practically impossible if it exists. In stereoscopic pictures two similar false images are presented before the eyes and create a false estimation of depth and direction because of an abnormal relationship between accommodation and convergence. Images on greatly disparate retinal areas normally are visualized separately but images on only slightly disparate retinal areas are, under certain conditions, superimposed and produce the impression of depth perception. The process of exteriorization is essentially centripetal and especially in binocular vision estimations of distance and direction are based on innate judgment as well as past experience. Binocular retinal impressions are localized at the reconstruction point of the principal and secondary axes. In a general way the horopter is the exteriorization of the visual impressions. Binocular alternation is an important factor in stereoscopic vision. Each optic radiation conveys only the impressions from the homolateral retina and therefore binocular alternation is considered essential for stereoscopic vision.

Chas. A. Bahn.

Wilson, W. H. **The Middle East adaptometer.** *Brit. Jour. Ophth.*, 1946, v. 30, Nov., pp. 645-657.

The author describes his apparatus

for determining night blindness as assembled by his British Army unit in the Middle East. No such machine was available and materials of any acceptable sort were scarce. The construction of the instrument is described in detail. It served the R.A.F. quite adequately as a form perception test, rather than merely a light perception test. (4 figures.)

Morris Kaplan.

4

OCULAR MOVEMENTS

Cristini, Giuseppe. **Clinical considerations on a case of progressive nuclear ophthalmoplegia.** Riv. Oto-Neuro-Oft., 1946, v. 21, March-April, pp. 98-107.

A woman, 30 years of age, with symptoms of pulmonary tuberculosis became afflicted at the age of 18 years with ptosis and paresis of the exterior muscles of the right eye after a long period of headaches and muscular and articular rheumatism. About 11 years later a ptosis of left upper lid and paresis of left internal rectus muscle appeared. The patient's eye condition could be diagnosed as chronic progressive nuclear ophthalmoplegia. That is a mesencephalic form of nuclear amyotrophy. (Bibliography.)

Melchior Lombardo.

Dickmann, G. H. **Total extracapsular removal of tumors of the hypophyseochiasmatic region.** Arch. de Oft. de Buenos Aires, 1946, v. 21, Jan.-March, p. 37.

The author uses the intradural approach, following Dandy's technique, for the removal of hypophysial tumors and favors the complete extirpation, rather than the curettage, of both the intra- and extrasellar portions of the growth. X-ray therapy must not be used as a sole treatment, but as a com-

plement to surgery. Two cases operated on successfully, one of cystic adenoma and the other of gliopithelioma, are reported to illustrate the author's procedure. (Photographs, photomicrographs and visual field charts.)

Plinio Montalván.

Filippi-Gabardi, E. **A note on the significance of the cortical center for voluntary ocular motility.** Riv. Oto-Neuro-Oft., 1946, v. 21, March-April, pp. 132-135.

In a discussion of experimental and histopathologic data the writer endeavors to demonstrate that the frontocortical oculogiric center controls solely the horizontal or vertical ocular movements. It is not a specific center for voluntary ocular motility.

Melchior Lombardo.

Gailey, W. W., and Morgan, G. E. **Surgical principals in strabismus.** Illinois Med. J., 1946, v. 90, Nov., pp. 274-279.

The essential questions arising in surgical care of strabismus are what muscle or muscles should be operated upon, how much is to be done, and what technique should be employed.

The choice of operation should be that procedure best known to the operator. The tenotomy is a useful operation when indicated and has been very successful when properly done. It is devoid of much of the trauma incidental to a recession. One of the indications for its application is in secondary contraction of a muscle.

Scleral trauma is to be avoided. The action of an operated muscle may be greatly affected by adhesions to the sclera central to its insertion. In re-operated eyes the authors have found the muscle firmly adherent as far back as the equator. Obviously, the muscle

action was correspondingly limited. Recession of the caruncle, an unfortunate and practically irreparable sequela can be avoided if there is less dissection of the conjunctiva and Tenon's capsule over the internal rectus.

How much to resect or recess is debatable and greatly depends on whether the anomaly is innervational, structural, or insertional. The authors' results in prism diopters of correction per millimeter of change in the position varied. The general principles laid down by them were: the maximum recession of a medial rectus should not exceed 4 to 4.5 mm., the lateral rectus 5.5 to 6 mm.; resection of lateral rectus 10 mm., medial rectus 5 mm.

Accuracy in diagnosis is strongly stressed. Especially important is the need for determining the status of the vertical muscles in all deviations. In combined deviations, correction of the horizontal deviation, if performed first, should be incomplete. The types of procedures recommended in the various deviations is discussed.

To facilitate orientation a dye dot is made at the 3, 9, 12, and 6 o'clock positions. Ten day chromic and plain catgut on atraumatic needles were found superior to silk sutures.

Francis M. Crage.

Schneck, J. M. *Voluntary nystagmus; case report.* Military Surg., 1946, v. 99, Sept., pp. 211-212.

The nystagmus in this young man was spontaneous, volitional, and bilateral. It was in the horizontal plane, pendular, very rapid, of large amplitude, and sustained. The movements of the eyes were symmetric. The oscillations were so rapid, once they were started by the individual, that they seemed to proceed in automatic fashion, in fact the factor of volition seemed

present only at the beginning and end of the activity. Francis M. Crage.

5

CONJUNCTIVA

Alvarado, P. J. *Contribution to the study of vernal conjunctivitis.* Bol. del Hosp. Oft. de Nra. Sra. de la Luz, 1946, May-June, pp. 153-168.

Incidentally the author refers to the old treatment of such cases, which consisted of covering the eye with a watch glass and strips of adhesive plaster. He discusses various theories as to causation, and various lines of treatment. He is disposed to regard the condition as chiefly arising from the combined effect of actinic light and hypovitaminosis. Particularly, he records three cases in children of the same family, in whom benefit appeared to be derived from prescribing a diet which supplied vitamins previously absent.

W. H. Crisp.

Araya C., Adrian. *Clinical study of hypovitaminosis A in the nursing mother. Test of conjunctival keratinization.* Arch. Chilenos de Oft., 1946, v. 2, Jan.-Feb., pp. 11-22.

The part played by vitamin A in various bodily functions is reviewed and the effects of its lack are discussed. The material utilized for the present research was obtained from 70 children, by the following technique. By separating the eyelids, the eyeball was exposed to the air for five minutes, at the end of which time the conjunctiva was gently scraped with the edge of a sterilized knife. The scraping was preceded by instillation of a five-percent-cocaine solution. The scraping was spread on a glass slide, stained with aniline oil and gentian violet followed by Lugol's solution, and fixed with absolute alcohol

and acid alcohol. The keratinized cells show intense staining and absence of nuclei. (References.) W. H. Crisp.

Chibber, P. R. Penicillin in follicular conjunctivitis. *Indian Jour. Opth.*, 1946, v. 7, Jan., p. 11.

The author describes a case of follicular conjunctivitis of six months' duration that responded to sulphanilamide penicillin ointment in one week.

Irwin E. Gaynor.

Campbell, M. D. Conjunctivitis-acute, hemolytic, staphylococcus aureus. *J. Michigan St., Med. Soc.*, 1946, v. 45, Dec., pp. 1615-1618.

Cultures were taken in 107 patients with this troublesome infection at the Army Air Base in Orlando, Fla.

The organisms present were non-hemolytic and slightly hemolytic staphylococcus albus and nonhemolytic and hemolytic staphylococcus aureus. The coagulose test as suggested by Thygeson was used in differentiating hemolytic staphylococcus aureus from other organisms.

Symptoms and treatment are discussed. In one case of hemolytic staphylococcus aureus infection, complicated by panophthalmitis, evisceration became necessary.

In all cases of hemolytic aureus infection the coagulose test was positive.

Francis M. Crage.

Lauda, E. Findings and treatment in Reiter's syndrome. *Wien. Klin. Wchnschr.*, 1946, v. 58, Feb., pp. 55-56.

Reiter's syndrome is characterized by conjunctivitis, polyarthritis, and urethritis. It usually appears within two to four weeks after an attack of gastroenterocolitis, especially dysentery, and is regarded as an allergic or anaphylactic rheumatic affliction following these

intestinal diseases. The author observed a patient who had these symptoms for three months and finally developed meningitis and encephalitis and died. The pathological report on the brain emphasized general hyperemia and perivascular lymphocytic and leucocytic infiltration. There seems no doubt that the intracranial disease has the same allergic or anaphylactic origin as the other manifestations and constitutes a part of the syndrome or a complication of it. Lauda recommends large amounts of salicylates (4 to 8 gm.) in one shock treatment and mentions that, in spite of failures, treatment with salicylates gives the best chance for success.

Max Hirschfelder.

Siotto, Giovanni. Diffuse bilateral plasmoma of the conjunctiva. *Rassegna Ital. d'Ottal.*, 1941, v. 10, July-Aug., pp. 400-416.

Pascheff in 1908 gave the name of plasmoma to hyperplasias of the conjunctiva which were rich in plasma cells. Such tumors are also found in bone marrow, lymph glands, orbit, and lacrimal sac.

In the eye they are most often found in the upper tarsus or superior fornix, and rarely in the lower lid. They are frequently associated with trachoma and develop slowly and are believed to result from prolonged inflammatory irritation. However, pathologists do not agree as to the etiology.

The author describes in detail the clinical and histologic changes in a case of plasmoma that occurred in a 31-year-old woman, who had trachoma. (3 figures).

E. M. Blake.

Siotto, G. Ocular lesions from the venom of eels. *Rassegna Ital. d'Ottal.*, 1941, v. 10, Nov.-Dec., pp. 594-609.

While cleaning eels some bile spurted

into the eyes of two patients described by Siotto. The symptoms produced were pain, burning sensation, and muco-purulent secretion. There was no corneal involvement. Experimentally, a keratoconjunctivitis was induced in rabbits' eyes. The meagre literature on the subject is reviewed.

Eugene M. Blake.

Sentoro, N. Tumors of the plica semi-lunaris. *Rassegna Ital. d'Ottal.*, 1941, v. 10, Nov.-Dec., pp. 586-593.

Two cases of new growth in the plica are reported. They were endotheliomas and proliferation developed in the vicinity of vessels, especially in one where definite vascular canals were evident. There was no necrosis, hemorrhage, or exudation, and only slight pigment formation was noted in one. (5 figures.)

Eugene M. Blake.

Zertuche, Abelardo. Contribution to the surgery of pterygium. *Bol. del Hosp. Oft. de Nra. Sra. de la Luz*, 1946, May-June, pp. 169-178.

With five illustrations of the various steps in the operation, the author gives a detailed description of the well-known McReynolds procedure, with a few slight modifications. W. H. Crisp.

6

CORNEA AND SCLERA

Blumenfeld, N. I. Staining of the conjunctiva and cornea, *Vestnik Oft.*, 1946, v. 25, pt. 3, p. 39.

An intense bilateral yellow stain of the conjunctiva and cornea, with reduction of visual acuity presented a baffling diagnostic problem, until it was discovered that the patient was insufflating powdered acridinine into the conjunctival sacs, as a home remedy for brucellosis. The stain remained un-

changed during a period of observation which extended for seven weeks, during which time visual acuity rose from 0.3 to normal.

Ray K. Daily.

Broendstrup, Poul. Atypical marginal ulcers of the cornea. *Acta Ophth.*, 1941, v. 19, pt. 2, pp. 163-172.

Three cases of chronic torpid corneal ulcer are reported. The destructive process began at the limbus and the deep ulcers gradually advanced toward the center. The loss of substance and infiltration were greater in the limbal zone. The adjacent episclera and conjunctiva were involved in the process, and the swollen, poorly vascularized, projecting conjunctiva looked like sickly granulation tissue. In two eyes healing was accompanied by a pseudo-ptyerygium-like extension of the conjunctiva into the bottom of the ulcers. The third was not healed when this report was made. Ray K. Daily.

Cornet, E. The surgery of blindness due to anterior segment cicatrization. *Ann. d'Ocul.*, 1946, v. 179, June, pp. 319-344.

In uncomplicated corneal opacities affecting vision a trephine total thickness keratoplasty is made with a 3 to 6 mm. trephine. Intracorneal sutures are placed into the implant before it is removed from the donor eye. After the transplant is placed in the recipient eye, its intracorneal sutures are fastened nasally and temporally by horizontally placed sutures. A wedge-shaped conjunctival flap based at the limbus above is drawn down over the implant and sutured to the limbus below. Complicating anterior and posterior synechias may be detached and opaque lenses removed before or after the keratoplasty. A limbal or U-shaped corneal flap incision may be used. The

flap is held in place by three vertical intracorneal sutures, one on each side and the third near the lower flap margin. The last is also used to hold the corneal wound open, that is away from the iris and lens, during the removal of synechias, cicatricial membranes, and cataracts. The creation of an epithelized descemetocoele for optical purposes may be of service in the absence of blood vessels, when there is minimal cicatricial tissue and intact corneal epithelium. Leaving Descemet's membrane intact, if possible, the trephined disc is removed, and a substratum is formed by Descemet's membrane. A wedge-shaped conjunctival flap may or may not be necessary. This type of operation which the author calls "keratocataphorase" may be performed in the center or periphery of the cornea or even in the sclera. Thirty-five operations on 22 patients are reviewed.

Chas. A. Bahn.

Doucet. **A case of disciform corneal blood staining.** *Ann. d'Ocul.*, 1946, v. 179, April, pp. 224-231.

After injury to the right eye by sling-shot, the usual inflammatory symptoms, hyphema and hypertension followed. Twenty days later, a diffuse golden opacity that could easily be confused with a dislocated lens, occupied the entire cornea. One month later the opacity had become disciform. A paracentesis was performed at that time. After six months the inflammatory symptoms had subsided and left complete seclusion of the pupil, iris atrophy, and cataract. (References.)

Chas. A. Bahn.

Hathi, H. J. **Interstitial keratitis.** *Indian Jour. Ophth.*, 1946, v. 7, Jan., pp. 6-9.

The author describes several inter-

esting cases of syphilitic interstitial keratitis. One patient was cured after nine years of continuous antiluetic therapy, a second cleared up after 18 months and only when his wife was treated. The last had congenital lues complicated by tuberculosis of the lungs and knees. Irwin E. Gaynon.

Hermann, C. **Lattice-like dystrophy of the cornea.** *Ophthalmologica*, 1946, v. 112, Dec., pp. 350-363.

The report concerns a Swiss family of which eleven members belonging to two generations were examined by the author. The clinical picture was typical of lattice-like (reticulate) corneal dystrophy in its different stages. The hereditary transmission was of the dominant mode. A keratoplasty performed on one member (50 years of age) furnished material for pathologic examination. The corneal epithelium was very irregular, thickened in some and reduced to one or two layers in other places. Bowman's membrane was absent. The main pathologic change was the deposition of amorphous or granular, basophilic, and acidophilic masses and concretions in the anterior layers of the stroma. The acidophilic masses were found only within the lamellae, the basophilic ones within and between the lamellae. The author gives an excellent description of the evolution of the disease.

Peter C. Kronfeld.

Just Tiscornia, Benito. **Semiological and physiopathological considerations on a case of retinal angiosclerosis.** *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Jan.-March, p. 52.

The author presents a case of retinal angiosclerosis with arterial hypertension studied with the neuroarteriolar test of Vidal and Damel, neurocapillary

test of Vidal and Malbrán, blood chemistry, and stereoscopic angioscopy. He concludes that phlebosclerosis predominates over arteriosclerosis, and advises a thorough semiological study of all patients with these modern techniques in order to arrive at a correct diagnosis and rational treatment. (Charts, bibliography.) Plinio Montalván.

Levkojeva, E. F. Regeneration of the external ocular membranes after injuries. Its clinical and prognostic significance in ocular perforations. *Vestnik Oft.*, 1946, v. 25, pt. 3, pp. 25-31.

A microscopic examination of 415 enucleated eyes shows that the regenerative process of the sclera and cornea does not take the form of the usual granulation; it has its own picture with characteristic proliferation of typical cellular elements, which morphologically resembles tissue culture in vitro. The dynamics of the process is characterized by great intensity. Under unfavorable conditions it leads to excessive proliferation, with a tendency of the proliferating tissues to penetrate into the inner structures of the eyeball. The eyeball represents a closed chamber similar to that used for cultures in vitro, and the experience of histologists should suggest measures for regulating the growth of these proliferating tissues. With excessive regenerative processes an independent process of fibromatosis takes place that differs morphologically from sympathetic ophthalmia, but clinically simulates traumatic iridocyclitis from which it should be differentiated. (3 photomicrographs.) Ray K. Daily.

Lund, Axel. A case of interstitial keratitis after phlegmon of the arm. *Acta Ophth.*, 1941, v. 19, pt. 2, pp. 147-152.

A nurse accidentally pricked her arm with a pin, which was contaminated by vomitus. She developed a phlegmon of the arm, and cultures from the pus showed a growth of proteus bacilli. Six weeks later she developed a conjunctivitis, complicated by mild symptoms of iritis, and an interstitial keratitis with a massive discoid infiltration. The pathogenesis of the ocular disease is discussed, and the author believes that it is analogous to endogenous gonorrheal conjunctivitis. Ray K. Daily.

Lund, Axel. A family with Groenouws hereditary dystrophy of the cornea. *Acta Ophth.*, 1941, v. 19, pt. 2, pp. 153-161.

Lund reports a case of the granular type of corneal dystrophy. A chart of the family tree of three generations reveals three affected members in the last two generations. The literature is reviewed. (Genealogical tree.)

Ray K. Daily.

Magitot, A. Pterygium and keratoplasty. *Ann. d'Ocul.*, 1946, v. 179, June, pp. 346-352.

The following operation for potentially recurrent pterygium is considered superior to buccal mucous membrane implants. With a 5 to 6 mm. trephine, one third of the cutting edge of which has been removed, a semilunar incision is made around the head of the pterygium. The cornea is marked to outline a future implant. The pterygium is excised from the cornea and conjunctiva with a keratome-like knife and scissors. At the site of the previous marking with the trephine an incision is made one half way through the cornea. This semicircular piece of cornea is then excised with a sharp cystotome and keratome. A similar piece of cornea is excised from a donor, or from the same

eye. If the graft is secured from a donor, the eye should have been immediately excised unless kept in hemolyzed serum in temperature of four degrees for not more than four to eight days. A conjunctival flap is dissected from above and below and held in place over the graft by two conjunctival sutures.
Chas. A. Bahn.

Pillat, A. Report on the appearance of keratomalacia in Austrian adults. *Wien. klin. Wchnschr.*, 1946, v. 58, pp. 557-560.

Xerophthalmia and keratomalacia, which are caused by deficiencies and insufficiencies in nutrition, were almost unknown in Europe, particularly in agricultural Austria. Before World War II there were only three reports concerning the findings of xerophthalmia in Europeans and these concerned inmates of public institutions. During 1945 and 1946 signs of vitamin A deficiency appeared in the population of Vienna. An increasing number of people had nightblindness (60 percent of all the patients admitted to the Eye Clinic). Prexerosis and Bitot's spots were noted in a smaller percentage of patients. Pillat reports four patients with advanced eye findings. He describes the clinical course in two infants whose eyes had large dry ulcers of the cornea and widespread corneal prexerosis. Two adults also had dry central corneal ulcers with reduction of sight to hand movements and finger counting. The author mentions that the lack of food was also responsible for a more serious course of other eye diseases like serpentic ulcers and for a number of post operative infections after intraocular surgery. He prefers pure cod liver oil to vitamin concentrates for treatment.

Max Hirschfelder.

Strakhov, V. P. Kuhnt's conjunctival flap in corneal perforations. *Vestnik Oft.*, 1945, v. 24, pt. 3, pp. 19-21.

Strakhov believes that the effectiveness of sulfa drugs in preventing infection eliminates the indication for Kuhnt's conjunctival flap, and that its traditional indications need revision.

Ray K. Daily.

Vrolijk, M. Corneoscleral cyst. *Acta Ophth.*, 1941, v. 19, pt. 1, pp. 44-51.

The author adds an eleventh case of congenital epithelial limbal cyst to the literature. The clinical appearance, surgical treatment, and the microscopic appearance of this cyst are described. Theories as to the origin of such cysts are stated. The most probable theory postulates that the cysts originate from vestiges of embryonic veins, which were not completely obliterated, or from capillaries, which missed the connection with the canal of Schlemm.

Louis Daily, Jr.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Azzolini, Umberto. Ossification of the choroid and sympathetic neuroretinitis. *Rassegna Ital. d'Ottal.*, 1941, v. 10, July-Aug., pp. 357-399.

Attention is called to the fact that the term ossification of the choroid is incorrect as the choroid is merely the tissue in which the newformed bone is pathologically developed. At the age of eleven years a girl suffered a penetrating wound of the left eye, which gradually decreased in size and was blind. Eleven years later photophobia and gradually decreasing vision was noted in the right eye. The important change in the sympathizing eye was a neuro-

retinitis, without involvement of the uvea.

An excellent review of the subject of bone formation in various tissues of the eye is given and an extensive bibliography. The author contends that bone develops from an inflammatory exudate which arises from the choroid. (3 figures.)
E. M. Blake.

v. Bahr, Gunnar. The physiologic importance of elimination of aqueous through the cornea. *Acta Ophth.*, 1941, v. 19, pt. 2, pp. 125-134.

The author reviews the literature and reports his investigations on rabbits. The findings confirm Ridley's results on enucleated eyes, and show that there is a normal loss of fluid through the cornea. The layer of lacrimal fluid, exercises an osmotic effect on the aqueous.
Ray K. Daily.

Baltin, M. M. Roentgenographic study of the drainage of aqueous from the anterior chamber. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 14-19.

Thorotrast, used as the contrast material, was injected into the anterior chamber of rabbits. The findings on 40 animals show that the thorotrast is gradually absorbed; it passes from the angle of the anterior chamber into the suprachoroidal space and simultaneously invades the stroma of the iris. Not once, in the 40 experimental animals, was it found to enter Schlemm's canal. Histologic examination of the enucleated eyes confirmed the roentgenoscopic findings. The particles of the contrast substance are carried away by the histiocytes which pass into the suprachoroidal space, and from there probably through the emissaries into Tenon's capsule. The histologic picture demonstrates also the part which the iris plays in the elimination of colloids

from the anterior chamber. It is possible that the route taken by the particles of thorotrast is not the physiologic pathway of drainage since the injection of foreign substances into the anterior chamber creates abnormal conditions. The literature is reviewed.

Ray K. Daily.

Barany, E. Role of ultra-filtration in the formation of aqueous humor. *Nature*, 1946, v. 158, Nov. 9, p. 665.

The present work was undertaken to test the alternative (2) that the amount of sodium entering the aqueous by secretion greatly exceeds the amount entering by ultrafiltration, even if ultrafiltration still supplies a considerable part of the fluid volume of the aqueous.

If the secretion is to supply almost all the sodium and the ultrafiltrate a considerable part of all the fluid, their respective sodium contents obviously must be markedly different. But as sodium is the absolutely dominant cation of the aqueous, a marked difference in osmotic pressure would necessarily accompany any large difference in sodium content. If alternative (2) were true, then the secretion would have a higher osmotic pressure than the ultrafiltrate. The aqueous, being a mixture of the two, would have an intermediate osmotic pressure, and this would depend on the proportions of the mixture. Thus, by reducing the amount of ultrafiltrate, one could change the osmotic pressure of the aqueous towards that of the secretion and, as the secretion is hypertonic, towards higher values of osmotic pressure.

The amount of ultrafiltrate (if any) in the aqueous of one eye was reduced by clamping the homolateral common carotid artery in rabbits. This greatly reduced the filtering pressure and there-

by the rate of ultrafiltration. The osmotic pressure difference between the two aqueous humors was determined by the Hill-Baldes thermo-electric method $1\frac{1}{2}$ to 2 hours after carotid closure. The mean difference between the side with closed carotid and the control side was -0.5 ± 1.1 mgm. sodium chloride per 100 ML (29 experiments on 22 animals, 3 to 9 determinations of osmotic pressure on each sample). Thus, the blood pressure reduction cannot have augmented the osmotic pressure by more than at most $-0.5 \pm 3 \times 1.0 = 2.8$ mgm. sodium chloride per 100 ML. This change is so small that ultrafiltration cannot play any considerable part in the formation of aqueous humor.

Theodore M. Shapira.

Costi, C., and Marñón, G. Uveoparotid fever (Heerfordt's syndrome). *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Dec., pp. 1122-1129. (See Section 17, Systemic diseases and parasites.)

Godtfredsen, Erik. Chronic iridocyclitis with neurologic symptoms. *Acta Ophth.*, 1945, v. 27, pt. 1, pp. 75-87.

The material for this first systematic investigation into the simultaneous involvement of the uveal tract and the central nervous system comprises 451 cases of chronic iridocyclitis, nine of which had neurologic symptoms caused chiefly by a transitory arachnoiditis in the posterior cranial fossa. Among the 451 patients 26 had benign lymphogranulomatosis; nine probably did, and the etiology in the others was presumably tuberculosis. Of the nine cases with neurologic symptoms five were diagnosed as benign lymphogranulomatosis, in two the disease was suspected, and two were tuberculous. It is

thus seen that iridocyclitis of benign lymphogranulomatosis presents neurologic symptoms 20 to 40 times more frequently than other forms of iridocyclitis. In all nine the iridocyclitis was bilateral, severe, and lasted from six months to five years. The neurologic symptoms were polymorphous. Unlike the symptoms of the iridocyclitis most of the neurologic symptoms were transitory, except in the patients with tuberculosis, who died, one of meningitis, and the other after a fall due to his cerebral lesion. Two of the nine patients presented Heerfordt's syndrome. The prognosis for the patient with iridocyclitis associated with neurologic symptoms is poor if the etiology is tuberculosis, but is much more favorable if the cause is benign lymphogranulomatosis. (1 table.) Louis Daily, Jr.

Goldmann, H. Further note on the outflow of aqueous in man. *Ophthalmologica*, 1946, v. 112, Dec., pp. 344-349.

Independently of Ascher (*Amer. Jour. Ophth.*, 1942, v. 25, pp. 1174-1209) Goldmann discovered and reported (*Ophthalmologica*, 1946, v. 111, pp. 146) conjunctival or subconjunctival vessels with clear colorless "cores" and red rims. Upon resumption of communications between Switzerland and the U.S.A. it became clear that these blood vessels were identical with Ascher's aqueous veins. In a number of indirect ways, Ascher has shown that the clear colorless contents of these vessels are in all probability aqueous. Goldmann offers two direct means of proving that the aqueous veins serve as outlets for aqueous. The colorless fluid within these veins can only be plasma or aqueous. Upon intravenous injection of a dye that penetrates poorly into the aqueous, the aqueous vein should re-

main colorless if it contains aqueous, and become stained if it contains plasma. Goldmann has used fluoresceine intravenously or by mouth in a number of patients with clearly visible aqueous veins and found that their clear portions remained clear while all conjunctival blood vessels showed greenish-yellow haloes. Another way of demonstrating the function of the aqueous veins has been to inject dilute India ink into the anterior chamber of a human eye with malignant melanoma immediately before the enucleation. A few minutes later the formerly clear portion of an aqueous vein was found to be occupied by stagnant dark fluid while all other conjunctival vessels had retained their normal color. Then there can be no doubt that the clear contents of aqueous veins consist of aqueous.

Peter C. Kronfeld.

Jona, S. Angio-sarcoma of the choroid. *Rassegna Ital. d'Ottal.*, 1914, v. 10, Nov.-Dec., pp. 557-575.

The author discusses the various hypotheses presented as to the histogenesis of tumors of the choroid and describes three cases of leukosarcoma. (4 figures.) Eugene M. Blake.

Katzenellenbogen, I. Recurrent aphthous ulceration of oral mucous membrane and genitals associated with recurrent hypopyon iritis (Behcet's syndrome). Report of three cases. *Brit. J. Derm. and Syph.*, 1946, v. 58, July-Aug., pp. 161-172.

Behcet's syndrome consists of aphthous ulceration on the oral mucosa, particularly that of the lower lip, sharp edged ulcers of the scrotum and root of the penis, and hypopyon iritis with hemorrhages in the vitreous and retina. The lesions are recurrent. Two of the patients also suffered from recurrent

erythema nodosum and epididymitis. There is a gradual loss of vision from recurrent hemorrhage. All the patients have a peculiar skin reaction in that wounds from the hypodermic needle are followed by erythema and pustule formation. Smallpox vaccine seems to be the best treatment.

Irwin E. Gaynon.

Loewenstein, A., and Foster, J. Malignant melanoma of limbus and spontaneous cyst of pigmented layer of iris in same sector. *Arch. of Ophth.*, 1947, v. 37, Jan., pp. 8-17.

A malignant episcleral melanoma, a spontaneous cyst of the posterior tissue of the iris, and a heavy deposit of pigment in the meshwork behind Schlemm's canal were observed in the same sector of the eye of a woman, 33 years of age, who also had bilateral congenital cataract.

It is suggested that fetal inflammation simultaneously produced the cyst, by preventing complete closure of the cleft between the two layers of the optic vesicle, and the melanoma, by displacement of the pigment-storing cells of the outer germinal layer. The congenital cataract and the heavy pigmentation of the meshwork behind Schlemm's canal probably originated in the same inflammatory process.

R. W. Danielson.

O'Reilly. Massive choroidal hemorrhage. *Arch. Chilenos de Oft.*, 1946, v. 2, Jan.-Feb., pp. 23-26.

A patient aged 15 years had an extremely violent pain in the right eye, increasing for five days, with marked redness and complete loss of vision in this eye. Examination showed edema of the lids and of the surrounding adnexa, some exophthalmos with retention of movements, clouding of the cornea, and

moderate shallowness of the anterior chamber. The iris was edematous, the pupil dilated ad maximum, intraocular tension plus three. The preliminary diagnosis was of retinal glioma. The enucleated eye showed massive choroidal hemorrhage with infiltration into the vitreous and retinal detachment. The condition is extremely rare. (2 illustrations.)

W. H. Crisp.

Rubino, A. The uveal-meningitic syndrome. *Riv. Oto-Neuro-Oft.*, 1946, v. 21, March-April, pp. 73-84.

Five cases of this syndrome are reported. Three of the patients were male and their ages ranged between 7 and 64 years. The syndrome consists of a bilateral, acute, exudative choroiditis, or iritis and irido-cyclitis, accompanied by neurologic and general disturbances. The disease starts suddenly, usually with high temperature, headaches, vomiting, delirium, and disturbances of sight which may lead rapidly to blindness. Blepharospasm with intense photophobia and lacrimation are usual symptoms. Conjunctival and pericorneal injections, and a turbid vitreous with intense papillitis and peripapillitis are always found, and some eyes have synechias. The disease lasted from one to three months and showed marked improvement after spinal punctures. Like Harada's and Vogt-Koyanagi's diseases this syndrome is obscure in etiology and pathogenesis. The association of uveal and meningeal symptoms suggests the importance of an embryonic, morphologic, and functional analogy between the uveal membrane and the leptomeninges.

Melchior Lombardo.

The author reports four cases, respectively of recurrent iritis, recurrent hyalitis, episcleritis, and uveitis, all apparently attributed to dental infection, but in none of which the result of attention to the diseased teeth is stated.

W. H. Crisp.

Sathaye, V. D. Iridectomy under a conjunctival flap. *Indian Jour. Ophth.*, 1946, v. 7, April, pp. 25-27.

After preliminary anesthesia, and bridle suture, the author makes a conjunctival flap, and an incision into the sclera just above the limbus from 11 to 1 o'clock which is gradually deepened until the anterior chamber is reached. The iris is then grasped by forceps and excised.

Irwin E. Gaynon.

Scullica, F. The pathologic vascularizations of the anterior surface of the iris. *Ann. di Ottal.*, 1946, v. 73, Feb., pp. 65-90; March, pp. 129-166.

From a mass of clinical and histological observations differential criteria are established for the recognition of three types of pathological vascularization of the iris.

In absolute glaucoma the site of predilection is the ciliary zone of the iris, and the vessels rarely extend further inward than the collarette; only in an advanced stage may a small branch here and there reach the pupillary zone. The vessels for the most part are narrow and their course tends to be parallel to the ciliary margin. Lying at different levels in the stroma they may emerge at any point and then, after a more or less undulatory course on the surface of the iris, reënter the stroma, without diminution of caliber. Sometimes they form a broad festoon with both its ends at the ciliary margin. Their branches, if any, are almost always terminal, but usually they do not

Sánchez H., J. R. Dental focal infection. *Bol. del Hosp. Oft. de Nra. Sra. de la Luz*, 1946, May-June, pp. 179-184.

give off collaterals or form networks. Occasionally they may have radial branches extending to the collarette where they may bifurcate.

In iridocyclitis the vessels for the most part have a radial course and are quite stout and tortuous, with frequent subdivisions and anastomoses. They usually originate at the periphery and tend to form networks of increasing compactness as they approach the pupillary margin. The sphincteric zone is always involved, and vessels may extend into the pupillary area with the formation of new connective tissue. Recognition of this type is facilitated by the presence of synechiae or a pupillary membrane or by the behavior of the uveal pigment.

In rubeosis the vascularization differs appreciably from that found in the other two types. Its site is by preference in the sphincteric zone; less commonly, in proximity to the ciliary margin. The vessels may be so small as to escape detection unless the slit-lamp is used; they typically take the form of fine networks or clusters, either isolated or connected by slender branches. One or two larger vessels, rarely as many as four, may extend outward in a radial direction. Partial ectropion of the uvea may also be present.

All three types are associated with glaucoma. In absolute glaucoma and typically in rubeosis the glaucomatous state precedes the vascularization, whereas the reverse is true in iridocyclitis.

In all three types, though less so in rubeosis, the anterior chamber is abnormally deep. (In most cases of absolute glaucoma there is no vascularization and the anterior chamber is not deep.) It is possible that the cause of the increased depth is to be found in the

marked venous stasis and consequent transudation.

In all three types the action of miotics is prejudicial. Mydriatics act beneficially by combating the venous stasis in the iris. Harry K. Messenger.

Sironi, L. Frequency of tuberculosis of the eye and its treatment with tuberculin. *Rassegna Ital. d'Ottal.*, 1942, v. 11, Jan.-Feb., p. 37.

Sironi gives an excellent survey of the opinions of various authors as to the frequency of tuberculosis as the cause of ocular disease. For instance, tuberculosis is believed to be the cause of all choroiditis by Courfein and of 20 percent of it by Uhtoff. Twenty cases of fundus disease are reported in detail, including exudative choroiditis, conglomerate tubercle, retinal hemorrhage, neuroretinitis, and periphlebitis. The skin reactions, vision, recurrence after treatment with tuberculin, and dosage of tuberculin are discussed. Five beautiful colored plates are included.

Eugene M. Blake.

Stocker, F. W. Experimental studies on the blood-aqueous barrier. *Arch. of Ophth.*, 1946, v. 36, Nov., pp. 612-616.

In order to understand better the abnormal variations of the intraocular pressure, one should know as much as possible about the normal mechanism of the exchange of fluid between the blood and the eye, the rate of inflow of the fluid and how this rate may be changed under various conditions. Several attempts have been made to supply the blood with a tracer substance, the presence of which could be demonstrated in the aqueous after passage through the blood-aqueous barrier. The fluorescein test is a useful method for studying the production and circu-

lation of the aqueous. but there is no accurate way of recording the concentration of fluorescein in the aqueous. Other substances have been used as tracers such as heavy water, and radioactive isotopes of sodium chloride and phosphorus.

A new method of recording fluorescence of the aqueous after intravenous injection of sodium fluorescein, using the Colman photofluorometer, is described. It is demonstrated that the diffusion of fluorescein from the blood into the aqueous of rabbits takes a fairly regular course between three and ten minutes after the injection, after which time it becomes irregularly increased. Further work is to be published soon.

R. W. Danielson.

Tucker, H. A. Penicillin treatment of acute syphilitic nephrosis and iritis. Report of a case. *Am. J. Med. Sc.*, 1946, v. 211, June, pp. 718-722.

A colored woman, 29 years of age, had dimness of vision due to an inflamed, painful right eye, of two weeks duration. After diagnosis had been made of secondary syphilis with nephrosis and acute iritis, the patient was given 600,000 Oxford units of sodium penicillin in 7½ days, which caused immediate and sustained improvement of the eye and of the renal lesion. The syphilitic infection itself was apparently cured 708 days after initiation of treatment. (2 figures, references.)

Bennett W. Muir.

Verhage, J. W. C. Juxtapapillary chorioretinitis (Jensen). *Ophthalmologica*, 1946, v. 111, June, pp. 351-358.

The author quotes Jensen's original description of the chorioretinitis which bears his name as well as van der

Hoeve's theory concerning the pathology of this disease.

A detailed case history is added. A man, 27 years of age, had typical chorioretinitis in his right eye with a striking lesion of a vein and many cholesterol deposits in the fundus. The apparently healthy left eye showed two old periphlebitic patches. The internal examination was negative, except for an increase in the blood cholesterol and an abnormal relationship between the free cholesterol and its esters.

The author believes that tuberculosis is the cause of juvenile retinal periphlebitis as well as of Jensen's chorioretinitis. Both diseases affect young, apparently healthy persons. (3 figures, references.)

Alice R. Deutsch.

Verrey, Florian. The practical importance of intraocular phagocytosis. *Ophthalmologica*, 1946, v. 111, April-May, pp. 222-228.

A systematic study of the cytology of the aqueous is recommended by the author. An exact knowledge of the cell content facilitates adequate chemical and vaccine treatment and provides the means to enhance the intraocular phagocytosis by appropriate measures. Microphages in the aqueous were found 96 times in 500 smears. An extraocular focus of infection, sometimes in combination with tuberculosis or syphilis was found in half of the cases. Three clinical histories are recorded as illustrations. (2 tables, 8 figures, references.)

Alice R. Deutsch.

Vidal, F., and Damel, C. S. The ocular neurovegetative system: blue eyes and brown eyes. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Nov., p. 593.

The authors investigated the myd-

riatic action of sympathomimetic drugs instilled in the eyes of 200 individuals of different sex and age. This investigation showed that mydriasis was greater in light colored eyes, even when the drug was used in weak concentration. The blue irides showed the maximal pupillary dilatation, with green, greenish-brown and brown following in decreasing degree of dilatation. The action of sympathomimetic drugs is very slight in dark brown eyes. In heterochromia the dilatation is very marked in the lighter colored eye. When neurovegetative dystonia is present the mydriatic action of the drug is evident, regardless of the color of the iris.

Plinio Montalván.

Woods, Alan C. The influence of hypersensitivity on endogenous uveal disease. *Amer. Jour. Ophth.*, 1947, v. 30, March, pp. 257-274. (References.)

8

GLAUCOMA AND OCULAR TENSION

Amat, M. M. The mechanism of action of antiglaucomatous operations. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Jan., pp. 69-81.

An exhaustive review of the literature and brief consideration of several of the author's clinical experiences lead him to the conclusion that all antiglaucomatous operations have a common mode of action; namely, they act directly on the ciliary body by modifying its innervation or vascularization, and indirectly on the eyeball. A new relation is thus established between the secretion and circulation of the intraocular fluids. The operations are actually arteriectomies and sympathectomies.

Ray K. Daily.

Barrio, A. The pathogenesis and medical therapy of acute inflammatory

glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Aug., pp. 676-692.

After an exhaustive review of the literature the author concludes that glaucoma is a symptom complex, the outstanding feature of which is the increased ocular tension, and the causes of which may be many, just as the causes of edema may be many. Barrio agrees with Terson that glaucoma is a localized edema. Diagnosis should be directed towards discovering the cause of the increased vascular permeability, be it a vegetative neurosis, an endocrine disturbance, intoxication, infection, allergy, or local or general vascular disease. The early stages of hypertension are practically always due to an increased capillary permeability, and it is only during this period that medical therapy can be effective. Diminution of the capillary permeability can be attained by etiologic treatment and by drugs that act directly on the vessels, such as iron oxide and calcium. Salicylates, antipyrin, and pyramidon also have been found to reduce capillary permeability. The effectiveness of the administration of antihistaminic agents, such as the biologic amines, and of histamine desensitization are being investigated.

Ray K. Daily.

Bolgov, P. J. Chiazzaro operation in glaucoma. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 77-83.

This is a detailed report of the implantation of magnesium into the anterior chamber in 39 eyes with glaucoma, which was absolute in all but ten. A conjunctival flap was made as in Elliott's trephine operation, a linear incision was made at the limbus, and a strip of metallic magnesium 2 by 4 mm. was partly introduced into the anterior chamber so that one third of it remained under the conjunctiva. Two

eyes developed late infections and were enucleated. The tabulated data show the effectiveness of the operation and Bolgov advocates its inclusion in the list of antiglaucomatous operations. (5 tables.)

Ray K. Daily.

Busacca, A. What have we learned about gonioscopy? *Ann. d'Ocul.*, 1946, v. 179, Aug., pp. 415-432.

After a historical and anatomical review the author states that gonioscopic synechias are not the expression of a specific pathologic process, but are evidences of different inflammatory processes which are first visible around the iridocorneal sinus. In uveitis with ocular hypertension the author has not observed any pathognomonic sign. Blood vessels do not normally exist in the region of the iridocorneal sinus though in severe uveitis a form of posterior pannus may be seen. After a very detailed study of 25 glaucoma patients and a less detailed gonioscopic study of many more, the author is convinced that there is in the iridocorneal sinus of the glaucomatous no sign characteristic and pathognomonic of glaucoma. The classification of glaucoma into wide and narrow angle types is of little practical value because although the scleral wall of the mouth of the irido-corneal sinus is fixed, the ciliary and iris walls are mobile and with their movements they modify the position of the angle and depth of the iridocorneal sinus. Sclerosis of the trabeculae is not visible gonioscopically. Salzmann showed in 1915 that mydriatics do not close the iridocorneal sinus but, on the contrary, facilitate its examination. Atropine and other cycloplegics do not cause mechanical blockage by pressing the iris against the wall of the irido-corneal sinus. Experimentally, eserine narrows the iridocorneal sinus which is widened

by atropine. Gonioscopy does demonstrate, however, that the iridocorneal sinus and the Canal of Schlemm play a very insignificant part in the production of glaucoma. (20 figures.)

Chas. A. Bahn.

Carreras Matas, B. Diagnosis of glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Dec., pp. 1093-1096.

There are three important signs of glaucoma, ocular hypertension, atrophy with excavation of the disk, and alteration the field of vision. Sometimes simple glaucoma is suspected but one should never dare to make a diagnosis unless one of the cardinal symptoms is present.

J. Wesley McKinney.

Casero, L. The association of nevus flammeus, glaucoma and Weber's syndrome. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, April, pp. 370-383.

A nine-year-old girl had a nevus flammeus in the region of the distribution of the first branch of the trigeminal nerve on the left side. The intraocular pressure was 60 mm. of Hg in the left eye. It was reduced to 45 mm. by pilocarpine, and maintained at that level for one year. She had an excavation of the optic disc, normal peripheral fields, and a central scotoma. Neurologic examination revealed a reduction in auditory acuity, bilateral disturbances in the pyramidal tracts, a left hemiparesis, and slight mental retardation. Radiography demonstrated a dilatation of the diploic venous sinuses of the left frontal region, and small calcifications above the alae of the sphenoid. The literature is briefly reviewed.

Ray K. Daily.

Dalsgaard-Nielsen, Esther. Buphthalmia. (A survey of buphthalmic patients admitted to the eye clinic of the

Rigshospital in the period of 1910-1943.) *Acta Ophth.*, 1945, v. 23, pt. 1, pp. 49-74.

The 49 patients found in this survey comprise 0.32 percent of the eye patients. In 35 percent the disease was unilateral. In 44 percent the diagnosis was made at birth, and in 38 percent within the first six months of life. One half of the patients were treated in their first year, and 20 percent under the age of three years. The material includes two families in which the disease was hereditary. The corneal diameter of the affected eyes ranged from 10.5 to 17 mm., with an average of 13.6 mm. Intraocular tension varied from 28 to 101 mm. Hg. and usually was between 40 and 70. Seven eyes were treated with pilocarpine. Seventy-four eyes were operated upon from one to six times, a total of 137 operations. The operation most commonly employed was Elliott's trepanation. Postoperative improvement was noted in 83 percent of the surgical patients. For 32 patients the period of observation ranged from 1 to 25 years. Many were observed for 10 years, and data on vision were available for 47 eyes. Of these 6 were enucleated, and 10 were blind; 10 eyes had less than 5/60 vision, 7 less than 6/24, and 8 had a visual acuity between 6/18 and 6/6. The value of early operation is evident from the fact that most of the patients with good vision were among those on whom the operation was performed within the first year of life. (9 tables.)

Louis Daily, Jr.

Dominguez, D. D., and Lucena, M. de T. **Glaucoma and the vegetative system.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Oct., pp. 865-870.

The data of the authors' investigations of the general state of the autonomic nervous system in glaucoma

show that 65 percent of patients with inflammatory glaucoma are amphotonic, and that patients with simple glaucoma suffer from dystonias of a mixed type. The local autonomic innervation was dystonic and with a constant increase in sympathetic excitability. As long as glaucoma remains in the phase of neurosis general medical therapy may regulate the general and local vegetative tone with arrest of the disease. The diagnosis must be made early, before local organic changes develop.

Ray K. Daily.

Duran, C. B. **Can glaucoma be an occasional cause of death?** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Jan., pp. 21-25.

Two cases are reported, in which glaucoma is considered the cause of death. The first occurred in a hypertensive, plethoric woman, who came for an eye consultation immediately after a heavy meal. After a diagnosis of preglaucoma she became excited, and developed an acute attack of glaucoma with severe headache and vomiting, which was followed in a few minutes by fatal apoplexy.

The second patient bled to death after a few days of uncontrollable hemorrhage that followed the enucleation of a hard, staphylomatous blind eye.

Ray K. Daily.

Epstein, E. **Report on a case of hydrophthalmia (Buphthalmos).** *Brit. Jour. Ophth.*, 1946, v. 30, Aug., pp. 476-478.

A soldier, 24 years of age, served through five years of battles without ocular symptoms. When he complained of headache his vision was found to be 6/60 and 6/18, corrected to 6/36 and 6/9. Shortly thereafter he developed absolute glaucoma in the right eye.

Both corneas were large; the corneal diameters were 14 and 13.5 mm., and the radius of curvature was 7.5 and 7.0 mm. in the right and left eye respectively. It was assumed that the megalocornea was an example of arrested hydrophthalmia which had suddenly become "decompensated."

Morris Kaplan.

Fialho (Sylvio), Abreu. **Heredity in glaucoma.** *Rev. Brasileira de Oft.*, 1946, v. 5, Sept., pp. 17-25.

The author cites two family histories, the former of which is thought to illustrate the rule of anticipation laid down by Albrecht Graefe, according to whom familial glaucoma appears with increasing precocity in successive generations of the same family. The second family tree recorded by Fialho shows glaucoma in three successive generations and, in a prodromal stage, in at least two members of the fourth generation. (2 genealogical trees, references.)

W. H. Crisp.

Fritz, M. H., and Kesert, Meyer. **Glaucoma following ingestion of sulfathiazole.** *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 197-198.

Gradle, H. S., and Sugar, H. S. **Glaucoma capsulare.** *Amer. Jour. Ophth.*, 1947, v. 30, Jan., pp. 12-19. (1 table, references.)

Grigorieva, H. I. **Experimental cyclodialysis on rabbits, with Heine and Zalman's technic.** *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 70-73.

The right eyes of six rabbits were operated upon by Zalman's technic and the left by Heine's. At various intervals after the operation a dye was injected into the anterior chamber, and shortly afterward the eyeballs were enucleated

and examined microscopically. The detailed protocols of the eyes reveal that in none of the eyes was the dye found in the suprachoroidal space. Detachment of the ciliary body was found in nine eyes; in one right and in two left eyes the ciliary body was in contact with the sclera. Hemorrhage into the anterior chamber was found in three right eyes and one left. Hemorrhage into the ciliary processes was present in five right and two left eyes; apparently such hemorrhages become absorbed slowly, for they were found in eyes enucleated 20 days after the operation. Perhaps the failure of some of the operations was caused by hemorrhage that blocked the drainage from the anterior chamber. There is no indication that the trephine opening has any significant advantage over the scleral incision, although it is closed by a less dense fibrous tissue than that which unites the scleral incision.

Ray K. Daily.

Hibbeler, H. L. **Personality patterns of white adults with primary glaucoma.** *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 181-186. (2 tables, 4 charts, references.)

Hughes, W. L., and Cole, J. G. **Technical uses of air in ophthalmology.** *Trans. Amer. Ophth. Soc.*, 1945, v. 43, pp. 115-135.

The authors review the uses of air in ophthalmologic radiography and surgery. Surgical experimentation on laboratory animals employing air goniotomy led to the adoption of a surgical technique by which it is possible for them to perform goniotomy in eyes with glaucoma with a shallow anterior chamber as well as those with a wide angle. By simply increasing the amount of air in the anterior chamber its depth

may be increased. They further demonstrated that a very distinct view of the anterior chamber can be obtained by substituting air for the aqueous, which makes a contact glass unnecessary in performing goniotomy. The authors have designed a goniotomy knife with a hollow shaft and an opening near the heel of the blade. By attaching two syringes, a system for withdrawing aqueous and supplanting it with air becomes practical. In three cases of glaucoma such goniotomy was at least temporarily successful.

C. D. F. Jensen.

Ivanov, N. K. Late results of cyclodialysis in glaucoma. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 66-70.

This is an analysis of 100 cases followed from two to eight years. Tension was permanently normalized in 70 percent of chronic inflammatory glaucoma, and in 51 percent of simple glaucoma. Visual acuity remained unchanged in 39 percent of chronic inflammatory glaucoma and in 17 percent of simple. In 26 percent of all cases the eyes became blind, and in 18 percent visual acuity was reduced to light perception because of cataract. Cataract that developed after the operation, particularly with hypotony, was due to a metabolic disturbance in the lens as a consequence of postoperative changes in the ciliary body. Reduction of visual acuity was seen in eyes with normalized tension as a result of progressive cataract or progressive atrophy of the optic nerve. The visual field remained unchanged in 60 percent of cases of chronic inflammatory glaucoma, and in 31 percent of simple glaucoma. The appearance and progression of myopia in emmetropic or hyperopic eyes occurred in 11 percent of cases, and an

increased myopia in myopic eyes in 3 percent. (2 tables.) Ray K. Daily.

Jona, Sergio. The importance of the hypophysis in regulating ocular tonus. *Rassegna Ital. d'Ottal.*, 1941, v. 1, March-April, p. 151.

The author found a hypofunction of the hypophysis in patients with various kinds of glaucoma. Imre examined 50 pregnant women and found a consistent hypotension, but Baratta could not confirm this. Jona describes the changes in the diameter of the pupil and the intraocular tension of rabbits and normal human beings after the injection of five units of vasopressin, a dose not harmful to man. The effect was studied on eyes under the influence of atropine and of eserine. No change was noted in the retinal arterial pressure or the visual fields. Vasopressin in man has a sympathicomimetic action and does not overcome atropine mydriasis, but in rabbits the effect is parasympathicomimetic and abolishes the mydriasis. In both man and rabbits a hypotension is developed, but is less evident in man. Further studies are needed to determine the actual value of this pituitary extract in the treatment of glaucoma. (10 figures.) E. M. Blake.

Kalfa, S. F. The management of increased intraocular tension in war injuries. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 55-58.

The development of secondary glaucoma following eye injuries is frequently overlooked. For an adherent leucoma the most effective surgical procedure is the double iridectomy proposed by Filatov. Two corneal incisions, made by the puncture and counterpuncture of a Graefe knife, or ab externo, and two iridectomies per-

mit complete separation of the anterior synechia, and restore normal conditions in the anterior chamber angle. Delayed restoration of the anterior chamber if not due to a fistulating wound is treated by a posterior sclerectomy with evacuation of a bead of vitreous. Secondary glaucoma in an aphacic eye is treated by cyclodialysis, through a small trephine opening in the sclera. Rise of ocular tension, caused by uveitis is controlled by alternation of miotics and mydriatics, by osmotherapy, and by retrobulbar injections of novocain. Fuchs's transfixion of the iris is performed for iris bombe, and in cases where this procedure fails it is followed by an iridectomy.

Ray K. Daily.

Kashuk, M. E. Elastotonometric studies in hypertension. *Oftal. Jour.* (Odessa),: 1945, pt. 2, pp. 9-15.

By means of elastotonometry Kalfa demonstrated that ocular tension is regulated by an intraocular vascular reflex. The stimulus to this reflex is variation in the intraocular vascular pressure, which is dependent on the general vascular pressure. Each rise in the general blood pressure leads to the simultaneous rise in the ocular tension, which promptly returns to its original level through the function of the regulating vascular apparatus. In the early stages of hypertension the lability of the blood pressure makes repeated demands on the intraocular vascular reflex which is compelled to compensate for frequent and sharp variations in blood pressure. As a result the sensitivity of this reflex is increased. This can be demonstrated by the method of elastotonometry which consists of measurement of the tension with the tonometer with four different weights.

In normal eyes the data when plotted, form a straight curve 10 to 12 mm. high. In hypertensive patients the curve is shorter and broken. Kashuk tabulates the measurements of 60 normal eyes in patients with general hypertension and illustrates the changes in the elastotonometric curve. Data show that the elastotonometric curve in 39.1 percent of these patients was 7.1 mm. shorter than the normal curve and sometimes also broken, and that the average rise of the elastotonometric curve in hypertensive patients is considerably lower than normal. It is believed that the shortening of the curve is due to the increased sensitivity of the local vascular reflex, and it is pointed out that the normal ocular tension of these eyes supports the generally accepted view that there is no relation between high blood pressure and glaucoma.

Ray K. Daily.

Leopold, I., and Comroe, J. Use of diisopropyl fluorophosphate ("DFP") in treatment of glaucoma. *Arch. of Ophth.*, 1946, v. 35, July, pp. 1-16.

The authors report in detail their experience and research in the use of this new drug on fifty patients. Koelle had previously determined that it is stable in peanut oil but not in aqueous solutions.

Diisopropyl fluorophosphate ("DFP") is an anticholinesterase agent capable of producing prolonged and marked parasympathomimetic effects in the eye. "DFP" has successfully lowered intraocular tension in glaucomatous eyes in 0.05 or 0.1 percent concentration in a peanut oil vehicle. In the majority of the glaucomatous eyes treated with 0.05 or 0.1 percent oily solutions of "DFP" the intraocular tension was controlled with decidedly

fewer daily instillations than when either 1-percent pilocarpine nitrate and/or 0.25 to 0.5 percent physostigmine salicylate in water was employed. In all glaucomatous eyes successfully treated with pilocarpine or physostigmine "DFP" was also effective and usually maintained the intraocular pressure at a lower level.

No instance of dermatitis or conjunctivitis due to repeated use of "DFP" was encountered in the 78 patients. In 36 of the 78 glaucomatous eyes in which treatment with pilocarpine or physostigmine had previously failed, "DFP" succeeded in maintaining intraocular tension below 30 mm. of mercury.

"DFP" has several untoward and undesirable ocular effects, namely, visual blurring, brow ache and eye ache, spasm of accommodation, and pericorneal injection. Two eyes showed an increase in tension. (References.)

R. W. Danielson.

Levina, L. S. The mechanism of raised intraocular tension. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 19-21.

The objective of this investigation was to determine the state of capillary permeability in glaucoma. In one group of patients Eppinger's test was used which consists of a 30-minute compression of the hand under a pressure of 40 mm. of Hg. Under normal vascular conditions pressure does not cause a flow of plasma into the tissues, until it is raised to 60 to 80 mm. of Hg. The number of erythrocytes in the blood taken before and after the removal of the pressure indicated changes in the blood concentration. Acceleration of the sedimentation rate indicates a loss of albumen from the blood into the tissues and is regarded as a sign of increased capillary permeability. A

change in the relation between the solid and liquid elements of the blood before and after compression of the hand also indicates a change in capillary permeability. In a third group of glaucoma patients a cantharides blister was produced, and its albumen content analyzed fractionally and compared with a similar examination of the blood. The tabulated data of these tests lead to the conclusion that glaucoma patients have an increased capillary permeability. The increased capillary permeability leads to a disturbance in the osmotic pressure, handicaps the flow of fluid from the anterior chamber, and leads to increased intraocular pressure. The increased intraocular pressure compresses the ocular veins at their point of exit from the eye and further increases the capillary permeability of the veins. The capillary wall also regulates the exchange of gases. A layer of fluid containing an excess of albumen between the capillaries and the tissues leads to a diminution of oxygen and an accumulation of carbon dioxide. The inadequacy of the oxygen supply probably accounts for the progressive loss of vision in eyes which have been operated on successfully for glaucoma. (2 tables.) Ray K. Daily.

Lijó Pavía, J. Provoked double retinal pulse; sign of preglaucoma? *Rev. Oto-Neuro-Oft.*, 1946, v. 21, May-June, pp. 47-51.

The author presents four patients with a mild increase in intraocular tension (32 to 38 mm. Hg). Using the ophthalmodynamometer to produce pressure on the eyeball, the usual venous pulse became associated with a retinal arterial pulsation. It is not claimed that this phenomenon may be interpreted as diagnostic of preglaucoma. (1 cinematograph.) Edward Saskin.

Magitot, A. *Lectures on glaucoma*. Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, Nov., pp. 1000-1013.

This is a digest of four lectures given by Magitot. He emphasized the importance of not confusing hypertension and glaucoma, although to many ophthalmologists these two terms are synonymous. The etiology of glaucoma is discussed, and a critical analysis is made of the symptoms considered typical of glaucoma. Magitot demonstrates that corneal edema and shallowness of the anterior chamber are not direct results of hypertension; that a Bjerrum scotoma is not diagnostic of glaucoma, that in glaucoma it is the minimum separabile and not the minimum visibile that is affected, and that disturbances of color vision and excavation of the optic disc are not dependent upon hypertension. The importance of local vascular disturbances and of the instability of the neuro-vegetative system in the pathogenesis of glaucoma are emphasized. He divides glaucoma into two types; that which appears in hyperirritability of the thalamus; and that which appears in the course of infectious diseases, which lower the psychic and physical resistance. He is logically sceptical of the indications for surgery in glaucoma, and believes that the disease can be controlled by local and general medical and psychic therapy. He also discusses infantile glaucoma and glaucoma without hypertension. Magitot had the opportunity to do a histopathologic examination of an eye with infantile glaucoma in an infant 1½ months of age, who died on the operating table. The examination revealed a buphthalmic eye, with a small lens, and diffuse intraocular and intraorbital vascularitis, similar to that found in syphilis. Like Charlin and Terrien, Magitot considers infantile glaucoma luetic, and

describes a patient in whom infantile glaucoma responded to antiluetic therapy. In general Magitot is a proponent of medical rather than surgical therapy of glaucoma and considers the retinal arterial tension the best guide in the choice of therapy. If the ocular tension is moderately high, and the arterial pressure normal or elevated medical therapy is indicated. A low arterial pressure is an indication for surgery.

Ray K. Daily.

Magitot, A. *Puncture of the anterior chamber*. Ann. d'Ocul., 1946, v. 179, March, pp. 159-163.

After paracentesis the initial decrease in ocular tension is followed by a secondary increase, which may be used as a provocative test in doubtful glaucomas. A positive Kahn reaction as well as tests for urotropin may be obtained from the reformed aqueous of persons in whom the same test made from the primary aqueous was negative. The reformed aqueous contains a higher concentration of serum albumins and globulins as well as of antibodies. Temporary improvement has often followed repeated paracentesis in primary optic atrophy and in chorioretinitis. The transient functional improvement was apparently due to retinal vascular hyperemia induced by the sudden reduction of intraocular tension. In some types of keratitis and uveitis repeated drainage of the aqueous may be of signal service especially at the most critical stages. A paracentesis wound ordinarily is covered by epithelial cells in 60 minutes.

Chas. A. Bahn.

Meyer, Otto. *Inflammatory jugular phlebostenosis as the cause of glaucoma exogenicum*. Brit. Jour. Ophth., 1946, v. 30, Nov., pp. 682-688.

Glaucoma exogenicum is a secondary glaucoma with an extraocular cause. This cause was traced by the author to an endophlebitis of the jugular veins. This phlebitis narrows the lumen of the vein and causes a damning back of drainage of the episcleral vessels. Glaucoma results. Chronic septic conditions of the mouth, teeth, and throat are blamed for this venous infection. The treatment of the glaucoma resolves itself into a recalibration of the jugular veins. Morris Kaplan.

Missiroli, Giuseppe. The behavior of the ocular tension after surgical procedures in the abdomen. *Boll. d'Ocul.*, 1945, v. 24, April-June, pp. 137-151.

The writer examined the changes in the tension in 59 patients for abdominal surgery. A lowering of tension was noted after severe operations and in patients in bad general condition. The hypotony disappeared when the general condition improved and increased still more in those whose condition became worse. The tension is useful in prognosis. (Bibliography.)

Melchior Lombardo.

Moreu, Angel. Surgical indications in glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Oct., pp. 859-865.

The objective of every surgical procedure on glaucomatous eyes is to provide intraocular drainage, and to modify the ocular circulation. The first is achieved without difficulty; the other is difficult to achieve and is the principal cause of surgical failure. The operative indication in the preglaucomatous stage is persistence of irregularities in the tension curve, rapid appearance of fluorescein in the aqueous, aggravation of hemeralopia, persistence of pupillary disturbances, and increasing field defects. The operation of choice at this

stage is cyclodialysis, which modifies favorably the iridociliary circulation by eliminating the function of a part of the ciliary body after setting up an aseptic iridocyclitis.

In chronic simple glaucoma the problem is one of inadequacy of intraocular drainage. If the fluorescein and nicotinic acid tests indicate an ineffectiveness of medical therapy, surgery should be resorted to without delay. Progressive loss of central visual acuity, constriction of the visual field, persistence of scotomas, deepening of the papillary excavation, and persistence of raised intraocular pressure are indications for surgery. Gonioscopic examination is of great importance in making the choice of the operation and in selecting the operative site. Vascular sclerosis in the retina and choroid is a contraindication to surgery. Advanced constriction of the visual fields is not as dangerous. Since most of these patients seek advice in an advanced stage of the disease a fistulating operation must be done. Cyclodialysis is effective only in aphacic glaucoma, or as a preliminary to a fistulating operation.

Chronic inflammatory glaucoma calls for a careful determination of the tension curve, the state of the refractive media, and the state of the pupil; if medical therapy does not normalize these processes the patient should be operated upon without delay by a fistulating operation if the inflammatory process subsides, or by an iridectomy ab externo if the congestion persists.

Acute glaucoma should be treated intensively medically, but if the eye does not respond to treatment an iridectomy ab externo should be done within 24 hours. Malignant or hemorrhagic glaucoma reacts unfavorably to surgery, and if it becomes unavoidable Vogt's cyclodiathermy or gonioscyclodiather-

my is indicated. The same procedures may be tried in absolute glaucoma, in the hope of avoiding enucleation.

Ray K. Daily.

Moreu, Angel. Studies of intraocular vascular permeability in the various phases of glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Aug., pp. 636-664.

The author regards vascular permeability as the most important factor in the genesis of glaucoma, and places great reliance on the information obtained from the fluorescein and nicotinic acid tests. He considers these tests imperative in the postoperative follow-up, and warns against neglect of medical therapy and against unjustified reliance on surgical normalization of tension. Medical postoperative therapy should be directed towards the improvement of the intraocular vascular circulation. Normal retinal arterial and venous pressures, with a normal relation to the pressure at the arm are good prognostic signs, whether therapy be medical, or surgical, or combined. Postoperative gonioscopic studies permit the inspection of the ciliary region in the area of the iridectomy or of the cyclodialysis. Edema of the ciliary processes that are more or less covered with a fine exudate and delayed elimination of fluorescein at the angle of the anterior chamber are signs of persistent circulatory stasis. If the circulatory disturbances continue, and venous obstruction develops, the atrophy of the optic nerve will progress, and blindness will result in spite of normal ocular tension.

Ray K. Daily.

Moreu, Angel. The etiopathogenesis of glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Aug., pp. 729-821.

This very exhaustive dissertation consists of a thorough review of the literature and a report of the author's investigations into many phases of the subject. His clinical material consisted of 543 cases, 537 of which occurred in people over fifty years of age. Age apparently is a significant etiologic factor, and it is in advanced age that circulatory disturbances, which Moreu considers the basic cause of glaucoma become frequent. Acute and inflammatory glaucoma is more frequent among women, whereas simple chronic glaucoma is predominant among men. A large percentage of glaucoma patients are hypermetropic. A small eyeball makes circulation more difficult and the metabolism of a hypermetropic eye is slower than that of a normal eye. This is shown by a slightly subnormal visual acuity in spite of a perfect refractive correction, by reduced light sensitivity and delayed adaptation, and by a retarded retinal chronaxia. The author does not believe that astigmatism is a factor of significance. Seasonal or climatic influences are factors only in the sense that they may precipitate acute attacks. Among the author's patients 482 had vascular diseases. An allergic attack in a glaucomatous person may precipitate an acute attack of glaucoma, but allergy does not cause glaucoma.

Pathologic studies indicate that glaucoma is primarily a disease of the uvea. The author found the angle of the anterior chamber open in all eyes with recent glaucoma. Obstruction is an indication of an advanced stage. He was never able to confirm Barkan's findings of sclerosis of the walls of Schlemm's canal, nor of trabecular flakes. No anatomic lesion, either in Schlemm's canal or in the trabeculae, can explain the genesis of glaucoma, and the author is convinced that the abnormality is in

the root of the iris and in the ciliary body. In these tissues there is evidence of circulatory stasis; when the angle of the anterior chamber is found closed, it is closed by uveal tissue. The cornea and sclera play a passive role.

The changes in the iris, are undoubtedly characteristic of glaucomatous disturbances. The parenchyma has a definite tendency to atrophy and to pigmentary changes. The pupillary reactions are slow, and there is a tendency to mydriasis. The ciliary body, observed gonioscopically, is edematous, and in iridectomized patients the edema can be seen to involve the ciliary processes. The choroid shows signs of circulatory disturbances, and with infrared light one can see atrophic areas, not demonstrable with ordinary illumination. The retinal disturbances, such as hemeralopia and visual field restrictions are due to lesions of the choroid. In incipient glaucoma the optic nerve is not involved, and excavation of the optic disc appears only in advanced stages of the disease. Among the experimental studies recorded is the author's attempt to produce hypertension in dogs by hyperglycemia. Hyperglycemia to the extent of producing coma and death did not produce any significant changes in the intraocular tension. It was also impossible to produce ocular hypertension by the intraarterial injection of drugs that raise the blood pressure. The intraocular pressure appears to remain independent of the general blood pressure. To demonstrate the role of Schlemm's canal the author injected india ink into the anterior chambers of dogs; at the end of four or five days the anterior chambers appeared clear; at this period the animal was killed and the eyes enucleated. Grains of india ink were found in the perivenous spaces, in Blesing's spaces, and in the perichoroidal

space: the canal of Schlemm's and the trabecular spaces were entirely free of the granules, indicating that the dye was not eliminated through these passages. The author believes that Schlemm's canal acts as a protective valve, providing filtration only in cases of increased intraocular pressure. To clarify the role of intracranial pressure in the genesis of intraocular hypertension the author induced intracranial hypotension by drainage of the lateral ventricles. This never led to atrophy of the optic nerve. After high ligation of the carotid artery or the jugular vein optic atrophy developed rapidly, indicating the pathogenic role of a circulatory disturbance. The author concludes that glaucoma develops because an initial neurovegetative dystonia causes a circulatory disturbance in the uveal vessels, as a result of which oscillations in the ocular tension are produced. The result of the persistent circulatory disturbance is a venous stasis that leads to increased capillary permeability and production of albuminous exudates, which block the drainage outlets. Schlemm's canal begins to function as a drainage safety valve and signs of hypertension appear. Nutritional disturbances follow, with inadequate production within the tissues of local vasoregulatory hormones. Further alterations in the intraocular pressure follow, with inadequate nutrition of the optic nerve, and with atrophic excavation. The author emphasizes that hypertension and glaucoma must not be confused. Hypertension must be regarded as one of the symptoms of glaucoma. Glaucoma must be recognized and treated as a primary vascular disturbance, with initial functional ocular changes that are followed by irreversible organic pathologic processes.

Ray K. Daily.

Moreu, Angel. The value of pupillography in the preglaucomatous state. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Sept., pp. 743-758.

Moreu's study is made with the Hess and Sander pupilloscopes, and he demonstrates that pupillography can be used to diagnose the functional adequacy of the local sympathetic and parasympathetic innervation. The pupillary reaction has three phases. A primary rapid phase under the influence of the parasympathetic; a second slower phase dependent on a relaxation of the sympathetic, and a third still slower period under the dominance of the sympathetic. Pupillographs taken after the instillation of parasympathetic and sympathicomimetic drugs demonstrate the functional adequacy of the local autonomic fibers. Pupillographic tracings illustrate the various pathologic states of the ocular organo-vegetative apparatus, such as sympathetic hyperirritability, hypoirritability and paralysis and similar states of the parasympathetic. The differential diagnosis of the various pupillary syndromes is described in detail. The author believes that this method affords diagnostic, prognostic, and therapeutic indications, and affords a means of determining the efficacy or failure of therapeutic procedures. (8 graphs.)

Ray K. Daily.

Orzalesi, F. Postoperative abolition of the anterior chamber—causes, consequences, remedies. *Ann. di Ottal.*, 1946, v. 73, March, pp. 167-182.

Orzalesi believes that obliteration of the anterior chamber and detachment of the choroid, which frequently occur after Elliot's trephining, are due to an excess of filtration and especially of diffusion beyond the limits of the flap. To prevent excessive diffusion he rec-

ommends preparing the flap in such a way as to have it bounded by a cicatricial line which will serve as a watertight barrier. He prefers Elliot's original triangular flap which has its apex 10 to 12 mm. from the limbus, which forms the base. The entire flap is dissected down to the limbus and is fastened by a single suture at the apex simply to keep it from being displaced by movement of the lids during the first few hours after operation. Since the conjunctiva retracts a little there is a narrow band of exposed sclera along the two sides. In the process of healing this becomes bridged by conjunctival epithelium without the interposition of a layer of subconjunctival tissue, and beyond this line the aqueous cannot pass. In this way a filtering cicatrix quickly forms under the flap. If the tension rises unduly in the process of healing he resorts to massage (but only when the anterior chamber has reformed). If the cicatrix becomes blocked, without other complications, he attempts to open it by cautiously freeing the conjunctiva.

Harry K. Messenger.

Parker, A. E. P. Bilateral detachment of the choroid of unusual duration following corneo-scleral trephine. *Brit. Jour. Ophth.*, 1946, v. 30, Oct., pp. 595-600.

In a woman, 56 years of age, with bilateral glaucoma simplex corneo-scleral trephining was followed by choroidal detachment in the upper nasal quadrant which persisted for a year before reattachment. A similar detachment in the other eye persisted for six months before recovery. (6 figures.)

Morris Kaplan.

Rønne, Gerhard. Penicillin treatment of late infection following fistulating

operations. *Ophthalmologica*, 1946, v. 111, Jan., pp. 1-7.

Four patients with late infection after a fistulating operation were given penicillin. In all of them the eye was preserved and in only one whose eye had been previously badly damaged did the eye lose its function. Moreover, in this case penicillin was administered intraocularly. In two the penicillin was injected subconjunctivally and was instilled and in one instillation alone was used. The subconjunctival injection of 4000 units of penicillin gives no complications at all. Treatment is very effective, all signs of inflammation disappear almost completely within 24 hours after injection. The author recommends the injection of 5000 units of penicillin subconjunctivally outside the infiltrated conjunctival area and instillations every 15 minutes during the first 24 hours. (References.) F. Nelson.

Scheglova, A. A. The effect of a fall in barometric pressure on the intraocular tension. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 21-28.

This study was made in the pressure chamber. The tabulated data show that lowered barometric pressure does not affect the ocular tension of the normal eye. A height of 2,000 to 3,000 meters does not affect the tension of eyes with compensated glaucoma but may prove dangerous to eyes with uncompensated glaucoma. The oscillations in ocular tension, under the influence of lowered barometric pressure may prove dangerous even to eyes with a tendency to increased intraocular pressure, especially in persons with disturbances in the cardiovascular and neurovegetative systems and in those with vascular hypertension. (3 tables.)

Ray K. Daily,

Schmerl, Ernst. Significance of action of paredrine on the ocular tension of rabbits. *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 187-189. (1 table, references.)

Sedan, J. Disc reimplantation after Elliot sclerectomy with cyclodialysis. *Ann. d'Ocul.*, 1946, v. 179, Aug., pp. 433-437.

Cyclodialysis is considered the glaucoma operation of choice in uveal disease. An Elliot trephine type of sclerectomy is made about 3 mm. posterior to the limbus. Elschmig's spatula is introduced in the trephine opening, passed through the suprachoroidal space and into the anterior chamber; it is then rotated about 45 degrees and withdrawn. The scleral disc is replaced in its original site and covered with a conjunctival flap. This technique is believed to minimize infection and other complications. Chas. A. Bahn.

Streiff, E. B. Generalized angiotrophoneurosis and glaucoma. *Ophthalmologica*, 1946, v. 3, Feb.-March, pp. 68-73.

A patient was observed in whom a diffuse angiotrophoneurosis was associated with extensive skin lesions and a bilateral glaucoma. A severe imbalance of the neuro-endocrinologic equilibrium was thought to be the origin of both the skin and the eye-changes. (3 figures, references.) Alice Deutsch.

Weekers, L. and R. Treatment of glaucoma by non-perforating cyclo-diathermy. *Bull. Soc. Belge d'Ophth.*, 1945, no. 81, April 29, pp. 50-63.

After experimental and clinical trial with non-perforating cyclo-diathermy, the authors feel that it has a very beneficial hypotensive action in the treatment of glaucoma. The effect is prin-

cipally that of uveal vasodilatation which modifies the aqueous humor and favors its absorption. Later there is a certain degree of atrophy of the ciliary body, which diminishes the production of aqueous and further lowers the ocular tension. In cases of chronic or sub-acute glaucoma, he has found it possible to lower the ocular tension to physiologic level after one procedure. If necessary, it is possible to augment the hypotensive effect by repeating the procedure after a suitable interval. Acute glaucoma, however, does not respond to this form of treatment. In secondary glaucoma and in chronic simple glaucoma the reduction in tension is less, but the procedure is sufficiently effective. In absolute glaucoma, this procedure most often helps avoid enucleation. A detailed description of the authors' technique is given. An electrode is applied directly to the eyeball seven millimeters from the limbus, without dissecting the conjunctiva.

M. R. Cholst.

9

CRYSTALLINE LENS

Arruga, H. A method to extract secondary cataracts. *Ophthalmologica*, 1945, v. 110, Sept.-Oct., p. 224.

In order to extract a secondary membrane in toto a capsule forceps is introduced into the anterior chamber through an incision in the limbus. The forceps is pushed down behind the iris if the pupil is not well dilated. Pressure is applied with the fixation forceps which forces the secondary membrane into the capsule forceps. These are then closed, the membrane is loosened by zigzag movements as in intracapsular extractions and easily extracted. (1 photograph.)

F. Nelson.

Arruga, H. The corneal section and sutures in cataract extraction. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, April, pp. 331-338.

Arruga stresses the importance of hypotension and avoidance of pressure with the fixation forceps in making a good corneal section. He is sure that a corneal section need not be made rapidly. He makes the section in the limbus, stops bleeding points with the point of a heated strabismus hook, and introduces three to five sutures through the cornea, sclera and conjunctiva. (Illustration.)

Ray K. Daily.

Atkinson, W. S. Preliminary report of corneal section with long bevel and conjunctival flap for cataract extraction. *Trans. Amer. Ophth. Soc.*, 1945, v. 43, pp. 97-114.

The author points out the influence of the corneal section on operative and postoperative complications in cataract surgery. In order to prevent a leaky wound with shallow or empty anterior chamber and to decrease the occurrence of postoperative hemorrhage into the anterior chamber he suggests a section with a long bevel, and one placed in avascular corneal tissue. He favors the use of a keratome directed away from the iris and toward the apex of the cornea so that the length of the bevel is increased. Such an incision tends to close more firmly and tightly when the normal intraocular pressure is restored or the intraocular pressure is increased, but he points out that with the long bevel placed forward in the cornea it is essential to tumble the lens. This type of corneal section with conjunctival flap made with keratome and scissors is safe and with it the number of postoperative leaky wounds is reduced. Although hyphema

still occurs, the hemorrhages are smaller and less frequent.

C. D. F. Jensen.

François, J. The complications of intracapsular cataract extraction. *Ann. d'Ocul.*, 1946, v. 179, May, pp. 280-295.

An analysis of 415 cataract operations performed during nine years is reported. Intracapsular extraction was attempted in 87 percent of the patients. In 11 percent the capsule was prematurely opened. The principal complications were: vitreous loss, 7.1 percent; striped keratitis, 8.3 percent; hyphaema, 7 percent; vitreous opacities, 5 percent; iridocyclitis, 4 percent; glaucoma, 3.6 percent; retinal detachment and iris prolapse, 3.3 percent; choroidal detachment, 0.6 percent; and wound infection, 0.3 percent. Among the less severe complications encountered were striped keratitis, hyphaema, and choroidal detachment. Those of moderate severity included vitreous loss and opacities, and iridocyclitis. The severe complications were glaucoma, retinal detachment and wound infection. The operative procedure is described in detail.

Chas. A. Bahn.

Gát, L., and Orbán, L. Acute psychoses after cataract operation. *Ophthalmologica*, 1946, v. 112, Dec., pp. 335-343.

Two cases of acute psychosis after cataract operation are analyzed from the psychiatric standpoint. The first patient, 24 hours after an uncomplicated bilateral cataract extraction, suddenly became disoriented and violent with very specific hallucinations relating to a fire in which his barn and all his fine cattle were being destroyed without anybody helping him extinguish the fire. At the top of his voice he gave a vivid and most detailed de-

scription of his visual and acoustic hallucinations. He did not comprehend reminders that he had been operated upon, that he was in the hospital, or that he had to be quiet. Under bromides plus paraldehyde he quieted down and recovered within 24 hours, with a complete amnesia regarding the psychosis. When questioned about a fire on his property, he refused to answer. From his wife the information was obtained that one week before the operation his barn had burned down, that he had taken an active part in extinguishing the fire and had, at the time, felt badly about the animals that had been destroyed, but had not mentioned the incident again until the outbreak of the psychosis. In the opinion of the psychiatrist, this suppression of a shocking incident may have made it impossible for the patient to adjust himself to it. Thus a complex developed in his subconscious. Such complexes play an important role in the development of reactive psychoses.

The other patient also became acutely disoriented 24 hours after the operation; the main theme of his "argument" was that he should be permitted to do his work instead of being restrained for which there was no reason. Within 24 hours he recovered, but on psychiatric examination proved to be depressed and worried about his ability to earn a living. Further investigation revealed that he had reason to worry about his financial future. His earning power had been greatly reduced by his diminishing eyesight and a former wife had cheated him out of a piece of property which he wanted to will to his present wife to whom he was deeply attached and grateful. Thus, the main mechanism of these two acute psychoses was a pathologic reaction to actual experiences to which the patient

had not had an opportunity of adjusting himself. Precipitating factors are the strange surroundings and the exclusion of the visual corrective orientation. Peter C. Kronfeld.

García Ochoa, R., and Etschemendigaray, A. Post-tetany cataract. *Anales Argentinos de Oft.*, 1946, v. 7, Jan.-Feb.-March, pp. 7-9.

In a 41-year-old woman who had hyperthyroidism for a long time a thyroidectomy of the right lower lobe was performed finally, without complications. On the third postoperative day, acute tetany manifested itself for which calcium was given intravenously. The attacks persisted and required three separate graftings of parathyroid tissue on each side of the trachea. Thirteen months after the first appearance of tetany total cataracts developed in each eye. These cataracts, the authors feel, were definitely associated with the tetany of hypoparathyroidism. For prophylaxis they suggest the use of high doses of calcium, perorally and intravenously, and parathyroid tissue grafts. Edward Saskin.

Koke, M. P. Ciliary dilation and vitreous recession in cataract extraction. *Amer. Jour. Ophth.*, 1947, v. 30, March, p. 327. (References.)

Saint-Martin, R. Errors in cataract practice. *Ann. d'Ocul.*, 1946, v. 179, April, pp. 232-236.

Reduced ophthalmoscopic illumination and a narrow beam facilitate the examination of lens details. Concurrent glaucoma, diabetic and other systemic diseases of the choroid and retina that increase the risk of operation often are not recognized. Generally speaking, when vision is less than 20/50 in the better eye operation should be done

upon the other, unless uveitis from lens hypermaturity has made operation necessary sooner. General diseases which may affect the risks of the operation should be routinely searched for. Infections involving the lids or sinuses may decide the success or failure of cataract operation. Cataracts secondary to uveitis are more easily removed by intracapsular extraction, which, however, is not infrequently followed by atrophy of the eyeball. Undue pressure on the iris and ciliary body is a frequent cause of delayed healing. Akinesia, retrobulbar anesthesia, and paralysis of the superior rectus are essential. Where orbital hemorrhage follows injection, operation is best postponed. Sufficient corneoscleral sutures to keep the wound sealed are advised. Sulfonamides and penicillin are used locally in conjunctival infections. Although premature handling of the eye may cause damage, the surgeon should be thoroughly familiar with the course and progress by the sixth day.

Chas. A. Bahn.

Samuels, Bernard. Cataract in intraocular tumors. *Trans. Amer. Ophth. Soc.*, 1945, v. 43, pp. 331-343.

The author presents the microscopic findings of cataract formation in 57 globes, each containing an intraocular tumor. In 34 globes the tumor was a malignant melanoma, in 21 a retinoblastoma, in one an epithelioma of the ciliary body, and in another a sarcoma that invaded the ciliary body. He stresses the fact that the tumor was not in every instance the actual sole cause of the cataract, but often the result of complications that develop in the globe during the growth of the tumor or during its degenerative changes. Of the 57 tumors 26 were in contact with the lens. Seventeen of the melanomas were

necrotic, 12 almost entirely so, and all of the retinoblastomas showed signs of necrosis. Excellent microscopic enlargements of the sectioned globe reveal various pathological details such as: folds in the capsule, proliferation of the subcapsular epithelium, necrosis of the subcapsular epithelium, changes in the lenticular substance, calcification of the lens substance, cystic spaces, and vesicular cell formation. He feels that whenever there is a combination of cataract and glaucoma, and there is the slightest possibility of intraocular tumor, it is advisable to recommend the removal of the globe. He emphasizes the importance of the differentiation in childhood between retinoblastoma and metastatic ophthalmitis. A special cause for diagnostic error in tumors concealed by cataract is failure to obtain a complete history. The earliest sign of disturbance in vision may be a distortion of objects, or an impression of dark waves before the eye, or a sensitiveness to light in a certain quadrant, or even dizziness.

C. D. F. Jensen.

10

RETINA AND VITREOUS

Bertotto, E. V., and Abrebanel, V. **Persistent hyaloid artery.** *Anales Argentinos de Oft.*, 1946, v. 7, Apr-May-June, pp. 48-50.

Two cases of unilateral persistent hyaloid artery are presented. The first patient had a vision of 6/12 in the affected eye, which was also the seat of an old extramacular choroiditis. The second had, in addition to the hyaloid artery, a divergent strabismus, and a central scotoma due to macular choroiditis. (1 illustration.)

Edward Saskin.

Cojazzi, L., and Grandi, G. **Relations between retinal arterial pressure and vestibular stimulation.** *Riv. Oto-Neuro-Oft.*, 1946, v. 21, March-Apr., pp. 85-97.

Researches were undertaken to distinguish in the mechanism of vestibular vegetative manifestations the factors of vestibular stimulation from the extravestibular factors. There was an increase in retinal arterial pressure during vestibular stimulation with heat (Veit's method), during simple backward flexion of the head without direct labyrinthine stimulation, and in rotary stimulation (Barany's method). In rotatory stimulation (Buys-Fisher) in which extravestibular stimulation was excluded the retinal arterial pressure was not modified. This shows that the ampullar stimulation cannot be the origin of retinal vascular phenomenon. The latter appear with other vegetative phenomena when stimulations of extravestibular origin occur. (Bibliography.) Melchior Lombardo.

Falcone, G. **Cyst in the vitreous and posterior cataract in retinitis pigmentosa.** *Indian Med. Gazette*, 1946, v. 81, Oct., pp. 417-418.

The author presents a case of primary pigmentary degeneration of the retina associated with posterior polar cataract in both eyes and a freely floating cyst in the vitreous of one of the eyes. The cysts have been found to be developmental anomalies of the hyaloid system and in some they seemed to result from intrauterine fetal disease. The posterior polar cataract and the cyst in this patient were considered to be due to embryonal changes in the hyaloid circulation and not to vitreous changes arising from the retinochoroidal disease. Francis M. Crage.

Hruby, K. Recent clinical and pathological findings in examinations of the vitreous. *Wien. Klin. Wchnschr.*, 1946, v. 58, Aug., pp. 461-464.

The posterior parts of the vitreous can be examined with the slitlamp by aid of the contact glass or of an interposed lens developed by the author. This method of examination gives us a more thorough understanding of vitreous pathology. Posterior detachment of the vitreous is a frequent occurrence and is found in axial myopia, in senility, in tapetoretinal degenerations, after contusions and perforations, and in retinal detachment. Clinically, so called "formed" vitreous opacities are a certain sign of posterior vitreous detachment. A total posterior detachment of the vitreous is the most frequent type found in younger individuals who retain the normal vitreous structure, whereas in myopic and senile individuals there usually is a destroyed structure that leads to vitreous collapse. In others there is only a partial posterior detachment and this detachment may occur near the optic disc or above or below. There is no doubt about the existence of a posterior limiting membrane of the vitreous. This assertion is based on the clinical findings, because many pathologic changes formerly thought to be within the vitreous are actually between this limiting membrane and the retina. Formed vitreous opacities, the proliferations of retinitis proliferans, and intraocular cysticercus are examples of this kind. Some perforating foreign bodies do not intrude into the vitreous, but lead only to its indentation and rest between the limiting membrane and the retina. Detachment of the vitreous itself scarcely influences the function of the eye, but in certain cases it is the

main contributing factor for retinal detachment. The rapid shifting of the vitreous mass during movements of the eyeball may lead to flaplike tears. This may even happen in cases of partial vitreous detachment. Posterior detachment of the vitreous is always found in cases of primary retinal detachment. It is usually absent in cases of secondary detachment of the retina due to tumors and retinal cysts.

Max Hirschfelder.

Koch, F. Ophthalmoscopic differentiation of arteriolar sclerosis: hypertensive and atheromatous. *Geriatrics*, 1946, v. 1, Nov.-Dec., pp. 438-441.

The most useful classification, from the ophthalmoscopic as well as the systemic clinical point of view, is that proposed by Wagener and Keith. These authors employ a numerical grading system of 1 to 4 describing the intensity and degree of deviations from normal with regard to smooth attenuation of arteriolar caliber, focal or superimposed localized arteriolar constrictions (so-called nicking), arteriolar sclerosis, and presence of exudates and hemorrhages. These numerical gradings correspond to the adjectives mild, moderate, marked and severe. The gradings thus applied aid appreciably in determining the prognosis within each group, and are designated as I, II, III, and IV.

Ophthalmoscopically, patients classified as Group I exhibit smooth and uniform attenuation of arteriolar caliber, with little if any arteriolar sclerosis. Those in Group II uniformly reveal some degree of arteriolar sclerosis, together with narrowing or attenuation of caliber, but also may exhibit focal constrictions. Varying degrees of narrowing and sclerosis will be present in Group III, in association with cotton

wool exudates and hypertensive hemorrhages of varying types. In Group IV papilledema will have been added to all the findings observed in the preceding groups.

This classification permits the concept that, while all patients do not run the entire gamut from Group I to Group IV to exitus, the patient may experience relapses or remissions that will permit reclassification with regard to prognosis and life expectancy as well as changes in treatment from time to time.

Theodore M. Shapira.

Manlove, F. Retinal and choroidal arterioles in malignant hypertension: a clinical and pathologic study of 15 cases. *Arch. Inter. Med.*, 1946, v. 78, Oct., pp. 419-440.

The wall to lumen ratios of the retinal and choroidal arterioles measured in this series are greater than those of the arterioles measured in any other organ studied by this method except the lung. This is in accord with the work of Coats, who stated that the walls of arterioles observed in the eye are thinner than those in any other organ.

The wall to lumen ratios of arterioles are definitely decreased in malignant hypertension.

The most common manifestations of arteriolar lesions seen were medial hypertrophy and intimal proliferation. The choroidal vessels were much more affected than the retinal. Hyalinization of part or all of the arteriolar wall was seen frequently. Acute necrosis was seen occasionally.

No relationship was demonstrated between the arteriolar disease and other retinal lesions.

Theodore M. Shapira.

Reca, A. B. Unusual posthemorrhagic hole of the macula. *Anales Argentinos de Oft.*, 1946, v. 7, Jan.-Feb.-March, pp. 10-13.

A woman, 29 years of age, with hypertension and hypertensive changes in the retinal vessels, had a sudden and spontaneous loss of vision in the left eye. Examination revealed a fresh, almost spherical macular hemorrhage. In a little over three weeks the hemorrhage had become absorbed and in its stead was a horizontally oval hole in the macula. There was no papillary change. This condition must be differentiated from a post-traumatic macular pseudocyst which is usually surrounded by pigment. (2 illustrations.)

Edward Saskin.

Redslob, E. The value of the venous retinal pressure. *Ann. d'Ocul.*, 1946, v. 179, July, pp. 367-374.

The venous retinal pressure is minimal in diastole and maximal in presystole. The retinal capillaries form a barrier between the arterial and venous pressure mechanisms. In arterial hypertension and hypotension, the retinal venous pressure is not affected. A spontaneous venous pulsation was observed in 75 percent of 180 persons examined ophthalmoscopically by the author. The average retinal venous pressure is slightly less than 24 mm. Hg. The maximal pressure varied from 20 to 35 mm. Hg and the minimal from 9 to 15 mm. Hg. Both venous and arterial pressures can be measured by the Bailart dynamometer or less accurately by pressure on the sclera through the upper lid simultaneously viewing the retinal vessels with the ophthalmoscope. Retinal venous pressure varies with intracranial pressure because the

cerebrospinal fluid in the intervaginal space is in contact with the central retinal vein. Five illustrative cases are presented. These include cases of arterial hypertension, and increased intracranial pressure associated with a brain tumor, arachnoiditis, meningitis, and unilateral exophthalmos. (17 references.)
Chas. A. Bahn.

Redslob, E. Quinine intoxication. *Ann. d'Ocul.*, 1946, v. 179, April, pp. 218-220.

A 31-year-old woman during the second month of pregnancy used three grams of quinine internally as an abortifacient. Six hours later a bloody mass was expelled from the uterus, but blindness and deafness occurred at the same time. The next day, the discs were pale, the arteries small and the veins normal. There was strong mydriasis and practically no light reaction. The following day a stellar infiltration about the macula was observed in both eyes and fingers could be counted at two feet. Small doses of iodides were administered. Four days later the patient had entirely recovered from ocular symptoms which were believed due to retinal vascular spasm. Among the drugs which also produce simultaneous sight loss and deafness are: male fern, pelleterin, santoniñ, chenopodium, apiol, aniline, and salicylic acid.

Chas. A. Bahn.

Rosenblum, M. E. The basic principles of surgery of retinal detachment. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 10-12.

Of 1000 retinal detachment operations, by diathermy coagulation performed at the Helmholtz Institute, 54 percent were satisfactory. The first operations for detachment with a macular

hole were done by diathermy coagulation, with an orbitotomy to afford access to the macula. At present the operation is performed without an orbitotomy. A temporary tenotomy of the external rectus is done instead.

Ray K. Daily.

Rubino, A. Tentative surgical treatment of Coats's disease. *Riv. di Oft.*, 1946, v. 1, May, pp. 285-291.

In three eyes of two patients, diathermy coagulation of the choroid was performed. By transillumination, the area to be treated was outlined on the sclera; mild, prolonged, and deep application of the diathermy current is recommended, transscleral first, and perforating at the end of the operation to allow for escape of the subretinal fluid. Visual field diagrams show some improvement in one of the eyes; slight increase of visual acuity was observed in all of the eyes. The greatest improvement was from perception of hand movements to 2/50. Pigment formation was observed in the treated areas, and for four months, the pathologic process did not progress.

K. W. Ascher.

Vidal, Flaminio, and Damel, C. S. Retinal angiosclerosis and the neuroarteriolar test. *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Jan.-March, p. 51.

The authors present the results of the neuroarteriolar test in retinal angiosclerosis. Variation of the intraocular pressure after stimulation of the arteriolar system of the eye with a sympathomimetic drug, such as ephedrine sulphate is observed. In 40 cases of retinal angiosclerosis the test was positive in 12 percent, negative in 75 percent, and inverse in 11.54 percent. The interesting feature in this study is the high percentage of inverse tests in an-

gioslerosis as compared with its absence in normal tension and physiologic hypotension. Plinio Montalván.

11

OPTIC NERVE AND TOXIC
AMBLYOPIAS

Carroll, F. D. Nutritional retrobulbar neuritis. *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 172-176. (3 figures, references.)

Fetterman, J. L., and Barr, J. H. Progressive syphilitic optic atrophy benefited by combined penicillin and fever therapy. Report of a case. *Arch. Derm. and Syph.*, 1946, v. 54, pp. 566-568.

The authors report a case of luetic optic atrophy with total blindness in one eye and progressive diminution in vision in the other eye. There was pallor of the disc in the better eye. The other disc was white. The Wassermann reaction of the spinal fluid was positive. Neurologic examination was negative.

Combined typhoid-malaria fever and penicillin therapy improved the vision in the better eye to almost normal. The blind eye remained unchanged. The patient returned to his work but suffered a recurrence 18 months later. Treatment has been resumed.

Francis M. Crage.

Fridman, S. J. Some characteristics of ocular involvement in craniostenosis. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 38-42.

Three patients had a history of headache and vomiting of many years duration, a fundus picture of old secondary optic atrophy, good visual acuity, and moderate constriction of the visual

fields. Roentgenoscopy revealed the presence of a moderate degree of craniostenosis. Ray K. Daily.

Hambreson, L., and Schepens, C. Tobacco amblyopia. *Ann. d'Ocul.*, 1946, v. 179, April, pp. 191-217.

The more or less excessive use of alcohol is considered of no practical importance in the development or severity of tobacco amblyopia. The hypersensitiveness of specific parts of the eye and eye brain to the several components of tobacco varies widely in different persons and depends on both genetic and environmental factors. Thus blindness has followed blowing tobacco smoke into an aching tooth cavity, and washing an itching skin with a tobacco lotion. Because of the inferior quality of tobacco and its defective fermentation during the war, tobacco amblyopia increased in France about 1000 percent.

The first symptom of tobacco amblyopia is usually a difficulty in recognizing colors, especially red. Vision is abnormally diminished in very bright light. These symptoms are usually binocular but not equally so. In monocular visual tests the patient more easily recognizes the letter to the nasal side, than the letter actually fixated. The initial lesion is a horizontal cocentral scotoma and is not pericentral. The peripheral field is usually normal, although occasionally a slight upper temporal constriction is observed. The relative increase of red over blue in scotomas is considered unimportant.

In 47 percent of a large series (the number is not mentioned) pallor and blurring of the temporal disc margin were observed. One third of the patients were less than 55 years of age, 47 percent were between 45 and 55

years, and 20 percent were more than 65 years of age.

Tobacco amblyopia must be considered part of a general intoxication which affects especially the autonomic nervous and cardiovascular systems. Tobacco is basically a vasoconstrictor, a hypertensor, a cardiac accelerator, and a miotic. The constitutional symptoms were greater, and recovery was less rapid in younger patients. Debilitating diseases, diabetes, syphilis, and some infectious diseases predisposed some individuals to tobacco amblyopia. Nicotine is detoxified in the liver where it is oxidized by glycogenic substances and produces a conjugate glucuronic acid. The basic pathologic lesion is a degeneration of the ganglion cells of the retina and atrophy of nerve fibers following a primary injury of the cones in the papulomacular area. The toxic substances reach the macular region through the retinal and choroidal capillaries which also degenerate. Production and action of the lipoid substance that is akin to vitamin A are interfered with, therefore red perception is reduced.

Complete abstinence from tobacco and maintenance of maximal nutritional activity are essential. The use of pilocarpine is of secondary value. (11 figures, references.)

Chas. A. Bahn.

Levatin, Paul. Atrophy of the optic nerve following hemorrhage. *Arch. of Ophth.*, 1947, v. 37, Jan., pp. 18-24.

After briefly reviewing the literature and discussing the theories, the author reports a case. Partial atrophy of the optic nerve developed in one eye in a 34-year-old white man during a massive hemorrhage from a duodenal ulcer and later in the other eye. Re-

peated determinations of the blood count and the blood pressure during this illness revealed a persistent state of peripheral circulatory failure and such an extreme acute anemia that ischemia is considered the chief etiologic factor in the production of the pathologic changes observed. The ophthalmologic findings suggest that ischemia can cause atrophy of the optic nerve either by producing degeneration of the retinal ganglion cells or by direct destruction of the optic nerve fibers in the region of the lamina cribosa. The former mechanism best explains the slow, delayed onset of partial atrophy of the right optic nerve in this patient, whereas the latter mechanism best explains the rapid, early onset of almost total optic atrophy of the left optic nerve.

R. W. Danielson.

Magnus, J. A. Bilateral partial coloboma of the optic nerve. *Brit. Jour. Ophth.*, 1946, v. 30, Nov., pp. 692-696.

Bilateral disc anomalies were seen in a 19-year-old boy. Both discs had rather marked nasal cupping. The tension was normal in each eye and remained so during provocative tests for glaucoma. Field defects exactly corresponded to the defects of the discs. A diagnosis of congenital coloboma of the nerves was made and glaucoma and cavernous atrophy were ruled out. (3 figures.)

Morris Kaplan.

Marthinsen, Reidar. The supraclinoid carotid aneurysm. *Acta Ophth.*, 1941, v. 19, pt. 2, pp. 141-146.

A case of a large median supraclinoid aneurysm diagnosed clinically, and verified at operation is reported. The early ocular symptoms consisted of markedly reduced visual acuity, con-

centric contraction of the visual field with a central scotoma, and loss of color vision in the right eye. A year later there was loss of vision and central scotoma in the left eye. Four years later there was still further deterioration of vision, and atrophy of the left optic nerve.

Ray K. Daily.

Ravasini, Carlo. An atypical case of Foster-Kennedy syndrome. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, March-April, pp. 133-152.

A 60-year-old male patient had migraine-like headaches on his right side for about three years and gradual loss of vision. While the headaches became less marked, the vision of his right eye was soon nil, and that of his left eye 3/10 with increasing constriction of the temporal field of vision. The right disc showed complete atrophy with sharp borders and normal retinal vessels, the left disc was slightly edematous, pale on the temporal side, and of almost normal color on the nasal. Later, the left disc showed a postneuritic atrophy. A meningioma of the right olfactory groove or of the smaller sphenoid wing was diagnosed. (3 X-ray photographs, 2 visual fields.)

K. W. Ascher.

Regoli, Attilio. Meningioma of alveolar type, originating from the sheaths of the orbital part of the optic nerve. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, May-June, pp. 174-193.

A woman, 42 years of age, noted watering of her left eye. Three years later there was slight protrusion of her left eyeball, lid edema, and a reduction of vision of her left eye to 5/10 without a central scotoma. There was no pain or muscular paresis and X-ray films failed to show pathologic changes in the orbit during the first year after visual loss was noted; later there was

a slight shadow in the left orbit. Seven years later, when the exophthalmos reached 12 mm., and the optic disc was pale and its borders hazy the left orbit had a definite shadow in the X-ray picture. A hard, nonfluctuating mass was felt through the upper lid, and was removed under local anesthesia. The tumor was adherent to the posterior part of the optic nerve, measured 4 by 2.5 cm., and proved, on histologic examination, to be an extradural meningioma of alveolar type. Discussion of the differential diagnosis, pathogenesis, and literature follows; 73 meningiomas of the optic nerve were found in the literature among 399 cases of optic nerve tumor. (4 photomicrographs.)

K. W. Ascher.

Rønne, Henning. The cytoplasmic inheritance in Leber's disease. *Acta Ophth.*, 1945, v. 23, pt. 1, pp. 89-93.

The author replies to Lundsgaard's comment on his criticism of her theory of the inheritance of Leber's disease. He finds support for his contention that the disease is transmitted through the cytoplasm of the ovum in an analysis of Lundsgaard's familial series, which shows that 93 percent (plus or minus 5 percent) of the females are carriers of the disease. This does not disagree with twice the standard deviation from the 100 percent inheritance which one would expect. He attributes the absence of inheritance through affected males to the infinitesimal quantity of cytoplasm in the spermatozoa. (1 table.)

Louis Daily, Jr.

Roberts, W. L., and Willcockson, T. H. Postneuritic optic atrophy in repatriated prisoners of war. *Amer. Jour. Ophth.*, 1947, v. 30, pp. 165-169. (References.)

Wagener, H. P., Smith, H. L., and Nickeson, R. W. Retrobulbar neuritis and complete heart block caused by digitalis poisoning. *Arch. of Ophth.*, 1946, v. 36, Oct., pp. 478-483.

Chromatopsia, frosted or snowy vision, and flickering sensations have repeatedly been described in digitalis poisoning. Retrobulbar neuritis has not previously been reported. The authors observed a man, 50 years of age, with a complete heart block as the result of digitalis intoxication. Corrected vision was 6/60 in each eye and yellow vision was noted. The fundi were normal. The field of each eye contained an 8-degree relative central scotoma. Blue was not recognized in any part of either field. The physiologic blindspots were slightly larger than normal. The vision returned to normal in about five weeks without treatment except for the withdrawal of digitalis and an increase in the amount of fluid ingested by mouth.

John C. Long.

Whitbourne, Dahlia. Nutritional retrobulbar neuritis in children in Jamaica. *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 169-171. (References.)

12

VISUAL TRACTS AND CENTERS

Bender, M. B., and Teuber, H. L. Ring scotoma and tubular fields; their significance in cases of head injury. *Arch. Neurol. and Psychiat.*, 1946, v. 56, Sept., pp. 300-326.

In the literature, ring scotoma and tubular fields have been attributed to retinitis pigmentosa, luetic chorioretinitis, myopia, glaucoma, optic neuritis, commotio retinae, migraine, nasal sinusitis, hysteria, solar retinitis, and head injuries. Many authors consider these visual defects psychogenic, even

in head injuries, if the retina is normal.

The author describes a patient with head injuries, in whom extensive studies were made. He concludes that scotomas, despite their variability, have an organic basis. F. M. Crage.

Klachko, M. L. Neuroophthalmic syndromes in fire-arm injuries of the occipital region. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 62-66.

The material for this analysis comprises 117 injuries to the occipital region. Fifty-two percent had hemianopsia, 11 percent concentric and other field defects, and in 36 percent the visual fields were normal. An analysis of the material and illustrative case reports lead Klachko to conclude that visual field defects and visual disturbances afford valuable diagnostic data in occipital injuries and localizing guides for the surgeon. Cortical blindness in occipital injuries is only infrequently permanent. When it lasts longer than a month it indicates an anatomic lesion in the visual centres. In injuries on a level of the external occipital protuberance hemianopsia is frequent. Heteronymous hemianopsia occurs in injuries in the midline of the occipital region. Homonymous hemianopsia is usually encountered in injuries to the lateral portion of the occipital region.

Ray K. Daily.

13

EYEBALL AND ORBIT

Benford, M. C., and Brunner, H. Involvement of the orbit in chronic inflammation of the frontal sinus. *Amer. Jour. Ophth.*, 1947, v. 30, March, pp. 297-308. (10 figures, references.)

Cutler, N. L. A positive contact ball and ring implant for use after enuclea-

tion. *Arch. of Ophth.*, 1947, v. 37, Jan., pp. 73-81.

Twenty-two patients were operated upon. Five implants were removed. A new implant embodying a new direct method of transmission of movement is described. This implant gives to the prosthesis a larger range and greater spontaneity of movement than any previously used. The operative procedure, postoperative care, and complications are discussed.

The only two other places in the body where a similar inert material projects to the exterior are the teeth and the nails. Time will tell whether these implants will be tolerated. This preliminary report is made one year from the date of the earliest retained implantation (August 1945).

R. W. Danielson.

Damel, C. S., Marino, Héctor, and Esperne, Pedro. Intraorbital dermoid cyst. *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Jan.-March, p. 24.

A case of intraorbital dermoid cyst in a 7-year-old girl is reported. The cyst was located in the floor of the orbit and communicated with the skin of the lower lid through a fistulous tract that followed incision of the mass when it was mistaken for an abscess. There was cicatricial ectropion of the lower lid. The cyst and fistulous tract were excised and the ectropion corrected later by means of a skin graft. A brief discussion of dermoid cyst of the orbit is presented. (Bibliography.)

Plinio Montalván.

Dobyns, B. Exophthalmos and tissue changes in the guinea pig following administration of the thyroid stimulating hormone of the pituitary gland. *West.*

J. Surg., Obst., and Gynec., 1946, v. 54, Nov., pp. 411-427.

Following injections of the thyroid stimulating hormone (TSH), of the anterior lobe of the pituitary body, conspicuous exophthalmos occurs in guinea pigs regardless of the presence or absence of the thyroid gland or the testes. Concurrently a generalized connective tissue reaction occurs throughout the body and, at the same time, a profound change occurs in the body fat. Fat depots are rapidly depleted and replaced by edema and connective tissue. Polymorphonuclear leukocytes and macrophages participate in this reaction and appear to be phagocytizing fat. Macrophages appear to become fibroblasts which lay down connective tissue.

As further evidence of profound changes in fat following injection of TSH, great quantities of lipid appear in the liver, kidneys, muscles, and in some epithelium and reticuloendothelial cells. Values for plasma lipoids are elevated and polymorphonuclear cells of the blood stream seem to contain increased quantities of fat.

The data suggest that, as a result of administration of TSH in quantities sufficient to produce exophthalmos, there is a generalized alteration in metabolism of fat throughout the body and that a connective tissue reaction is associated with it. Thus, many of the changes in the orbital tissue which produce exophthalmos are expressions of generalized tissue changes.

Theodore M. Shapira.

Sedan, J., and Poursines, Y. Non-traumatic intraocular blastomycosis. *Ann. d'Ocul.*, 1946, v. 179, July, pp. 399-405.

A 52-year-old woman had severe exudative uveitis and hypopyon in one eye, which ultimately led to enucleation. The vitreous of the enucleated eye contained a cryptococcal type of blastomyces with characteristic buds which were adherent to the retina. Six months later the other eye was also enucleated because of a similar condition. The literature is briefly reviewed. (3 figures)

Chas. A. Bahn.

Sharkanskaya, P. I. **Chondrosarcoma of the orbit.** *Vestnik Oft.*, 1946, v. 25, pt. 3, p. 38.

This malignant tumor originated from the roof of the orbit and extended towards the cranium in a man 56 years of age.

Ray K. Daily.

Strakhov, V. P., and Bochever, E. M. **Extraction of orbital foreign bodies.** *Vestnik Oft.*, 1946, v. 25, pt. 3; pp. 6-9.

Seventy-four of 204 intraorbital foreign bodies were successfully extracted. In two cases the attempt at extraction failed. Each case is an individual problem, and the decision to extract the foreign body should be determined by the findings in each particular case. Three illustrative cases are reported.

Ray K. Daily.

Verzella, Mario. **Hamartoblastoma (Lymphangioendothelioma) of the orbit, simulating a tumor of the lacrimal gland.** *Riv. di Oft.*, 1946, v. 1, May, pp. 343-353.

A woman, 58 years of age, entered the hospital with what appeared to be a tumor of her right lacrimal gland; biopsy revealed the presence of a lymphangioendothelioma, which was removed with some difficulty because of its unexpectedly large size. Photographs showing the patient before and

after the operation are added, as well as five photomicrographs of the different parts of the tumor. No recurrence was observed in two years. (7 illustrations.)

K. W. Ascher.

14

EYELIDS AND LACRIMAL APPARATUS

Fox, S. A. **Some methods of lid repair and reconstruction. III. Socket reconstruction with epidermis.** *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 190-196. (8 figures, references.)

Gill, W. D. **Dacryocystorhinostomy.** *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 198-200.

Khurgina, E. A. **Blepharoplasty in war injuries.** *Vestnik Oft.*, 1946, v. 25, pt. 3, pp. 31-33.

The results of 196 plastic operations on the lids after war injuries are analyzed. Free transplants were used in 89 cases, grafts with a broad pedicle in 44, grafts with a narrow pedicle in 23, and transposition of tissues in 42 cases. Transplantation of fat was used freely to fill defects, and in some cases both fat and skin were successfully grafted. Khurgina emphasizes the importance of excising all cicatricial tissue; by surrounding the graft with normal tissue the post-operative shrinking is reduced to a minimum.

Ray K. Daily.

Philips, Thygeson. **Etiology and treatment of blepharitis.** *Arch. of Ophth.*, 1946, v. 36, Oct., pp. 445-477.

Detailed etiologic and therapeutic studies were made on 350 cases of marginal blepharitis encountered in military personnel. Only three important etiologic types could be distin-

guished in this series, namely: blepharitis due to seborrheic dermatitis, to pathogenic staphylococci and to hemophilus duplex (Morax-Axenfeld diplobacillus). There was a high incidence of mixed seborrheic and staphylococcic blepharitis. The three main etiologic types had distinct clinical characteristics and in their pure forms could be differentiated on clinical grounds alone in all but a few cases in which the staphylococcus blepharitis simulated hemophilus duplex blepharitis. Microscopic examination of scrapings from the lid margins facilitated determination of the etiologic agent. The finding of budding yeast forms, believed to be *Pithrosporum ovale*, was considered a diagnostic sign of seborrheic blepharitis, although its etiologic role in seborrheic dermatitis is still unsettled. Routine biomicroscopic examination of the lid margin in cases of chronic conjunctivitis revealed a high incidence of mild or subclinical blepharitis, which was usually staphylococcic. It is suggested that most cases of chronic conjunctivitis have their origin in blepharitis.

Treatment was carried out with a wide variety of agents. Seborrheic blepharitis responded best to treatment that consisted of daily mechanical cleansing of the lid margins, frequent expression of the Meibomian glands, applications of 0.25 percent solution of silver nitrate to the conjunctiva and 1 percent silver nitrate to the lid margins twice weekly, applications twice daily of an ointment containing 1 percent salicylic acid and 1 percent yellow mercuric oxide to the lid margins, and treatment of associated seborrheic dermatitis of the scalp, brows, and external ears. Sulfathiazole and penicillin applied in ointment form were ineffective.

Staphylococcic blepharitis responded well to topical treatment with the following preparations, listed in order of efficacy; penicillin, sulfathiazole or sulfadiazine, and such mercurial preparations as ammoniated mercury ointment and a combination of 1 percent mercuric oxide and salicylic acid in a petrolatum base. Administration of staphylococcus toxoid proved to be an important supplementary procedure. Staphylococcic blepharitis complicated by inflammation in the Meibomian glands was much more resistant to therapy than uncomplicated blepharitis. Blepharitis due to *Hemophilus duplex* responded completely and rapidly to topical application of sulfathiazole ointment.

John C. Long.

15

TUMORS

Amerbach, J. C., Walter, E. M., and Sperti, G. S. Treatment of basal cell epithelioma by injection of tissue extract. *Arch. Derm. and Syph.*, 1946, v. 54, Aug., pp. 119-132.

The author presents a preliminary report on the treatment of basal cell epithelioma by injections of liver or spleen extract. Multiple intradermal injections produced complete regression and disappearance of the lesion in 14 cases (66 percent) and favorably affected another 6 cases or 28 percent. Control injections of procaine, which was the anaesthetic, and dextrose solution did not affect the lesions, and the extracts had no effect on normal tissue.

Orwyn H. Ellis.

Bushard, W. J. Intraocular malignant melanomas of the choroid. *Minnesota Med.*, 1946, v. 29, Oct., pp. 1005-1007. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Picena, J. P., and Paez Allende, F. **Achromis choroidal melanoma.** *Anales Argentinos de Oft.*, 1946, v. 7, April-May-June, pp. 30-47. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Sharkanskaya, P. I. **Chondrosarcoma of the orbit.** *Vestnik Oft.*, 1946, v. 25, pt. 3, p. 38. (See Section 13, Eyeball and orbit.)

16

INJURIES

Abramowicz, I. **Deposition of mercury in the eye.** *Brit. Jour. Ophth.*, 1946, v. 30, Nov., pp. 696-697.

Almost nightly for 41 years a woman applied mercury ointment to her eyelids for blepharitis. For ten years she has complained of an abnormal bluish-gray coloration of her lids. Deposition of mercury was found in the skin of the lids, the conjunctiva, Descemet's membrane and in the anterior lens capsule. Treatment was without benefit.

Morris Kaplan.

Bellows, John G. **Observations on 300 consecutive cases of ocular war injuries.** *Amer. Jour. Ophth.*, 1947, v. 30, March, pp. 309-323. (8 tables, 12 figures, references.)

Doherty, W. B. **A case of a splinter of glass in the anterior chamber of four years' duration.** *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 177-181. (2 figures, references.)

Doucet. **A case of disciform corneal blood staining.** *Ann. d'Ocul.*, 1946, v. 179, April, pp. 224-231. (See Section 6, Cornea and sclera.)

Itsikson, L. E., Valuiskaya, E. N., and Plastinin, N. V. **A rare case of a**

large foreign body penetrating both orbits, with preservation of ocular function. *Vestnik Oft.*, 1945, v. 24, pt. 4, pp. 46-48.

A child, 13 years of age injured his eyes with a toy gun; when he reached the Eye Institute three months later he had a conjunctival fistula and a flat retinal detachment of the right eye, and a large nail that passed through the ethmoid labyrinth was imbedded in both orbits. After extraction of the nail, the retina became reattached, and 12 days later vision was normal in each eye.

Ray K. Daily.

Krasnov, M. L. **Faulty light projection.** *Vestnik Oft.*, 1946, v. 25, pt. 3, pp. 21-24.

On the basis of his military experience Krasnov believes that the prognostic significance of faulty light projection needs revision. Five cases are reported to show that eyes with faulty light projection are not necessarily lost. Krasnov also doubts the justification of many early enucleations for fear of sympathetic ophthalmia.

Ray K. Daily.

Loewenstein, A., and Foster, J. **A contribution to the knowledge of ocular siderosis and posterior degenerative pannus.** *Amer. Jour. Ophth.*, 1947, v. 30, March, pp. 275-288. (15 figures, references.)

Schlaegel, T. F., Jr., **Histopathology of atomic-bomb casualties.** *Amer. Jour. Ophth.*, 1947, v. 30, Feb., pp. 127-135. (5 figures, 2 tables, references.)

Smirnov, V. A. **A case of internal ophthalmoplegia caused by injury of the ciliary ganglion in a fire-arm ocular contusion.** *Vestnik Oft.*, 1945, v. 25, pt. 3, pp. 42-43.

A soldier, 23 years of age, sustained an injury which led to an abscess of the right frontal lobe and enucleation of the right eye. After recovery his left eye was found to have fundus changes, impaired visual acuity, and an internal ophthalmoplegia. These changes were attributed to an ocular contusion and the ophthalmoplegia is regarded as a result of a contusion of the ciliary ganglion.

Ray K. Daily.

17

SYSTEMIC DISEASES AND PARASITES

Albeaux-Fernet, M., and Loublé, G. **Modern concept of the adiposogenital syndrome.** *Arch. d'Opht.*, 1946, v. 6, no. 3, pp. 257-272.

The authors describe in detail the symptomatology of this syndrome and note the importance of differentiating it from dystrophia adiposogenitalis, essentially an incomplete form of the syndrome in which there are neither radiologic nor ophthalmologic signs and in which the obesity is generalized and not segmentary as in the complete syndrome. They differentiate the syndrome sharply from hydrolipopexia, Cushing's disease, adrenogenital syndrome, and the obesities of castration and the menopause. They conclude that errors in differential diagnosis are unfortunately frequent.

The importance of radiologic and ophthalmologic examination in every patient whose condition suggests this syndrome is stressed. The radiologic examination in a typical case with a chromophobic adenoma of the pituitary gland shows changes in the sella turcica including overall enlargement which is exaggerated in the antero-posterior diameter with modifications in the clinoid processes. Bony changes are seen in the sphenoidal sinus even

earlier and more constantly. The sinus loses its normal quadrilateral shape to become triangular, the triangle's base anterior. The cases with tumors of Rathke's pouch are more easily diagnosed radiologically. In 75 percent of cases calcified nodules are seen in the tumors. These, combined with changes in the sella turcica, are highly diagnostic. Ventriculography also yields important information in cases in which other diagnostic methods are inconclusive.

The ophthalmologic examination with visual field studies is even more important than the radiologic examination. It is not only essential for diagnosis of the pituitary lesion but is the only reliable means of following the results of therapy. The characteristic eye finding is bitemporal hemianopsia but unilateral temporal field defects may occur and rarely a homonymous hemianopsia or unilateral amaurosis. Ordinarily vision is affected late as are the pupil and fundus.

The authors describe in some detail the various modifications of the syndrome and its relationship to the syndrome of Laurence-Bardet-Biedl. Etiologically they consider the pure syndrome to be due to a chromophobic adenoma or to a craniopharyngioma. With respect to treatment they discuss radiotherapy and neurosurgery and conclude that surgical intervention is now the treatment of choice to be resorted to when there are important ophthalmological changes such as bitemporal hemianopsia or signs of optic atrophy. Phillips Thygeson.

Costi, C., and Marñón, G. **Uveoparotid fever (Heerfordt's syndrome).** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Dec., pp. 1122-1129.

The authors report their observation

of Heerfordt's syndrome, characterized by bilateral uveitis, swelling of the parotid glands and low grade fever between 99 degrees and 100.5 degrees, in a woman, 49 years of age. There also was swelling of the submaxillary and lacrimal glands.

J. Wesley McKinney.

Esente, Ivan. Photophobia with infantile acrodynia. *Riv. di Oftalm.*, 1946, v. 1, June, pp. 392-408.

Infantile acrodynia, also referred to as vegetative neurosis, erythroedema, trophodermatoneurosis, dermatopolyneuritis, occurs not infrequently in northern Italy. The majority of cases described in the literature had, among other manifestations, a rather severe photophobia, which also was present in five patients observed by Esente. There was no pain, and only slight lacrimation and a mild blepharospasm. Only one of his patients complained of a coexisting headache, one had a very mild conjunctival hyperemia, and none showed any corneal or uveal disease, orbital or periorbital lesion, paresthesias, or vasomotor or trophic disturbances. The acroparesthetic symptoms and the complaints of pain always preceded the photophobia, which, however, itself preceded or accompanied the appearance of mental symptoms such as insomnia, asthenia, dysuria, and emaciation. With general improvement the photophobia disappeared earlier than the diencephalic disturbances. After an extensive discussion of the pathogenesis of acrodynia and of different types of photophobia, the author concludes that in acrodynia there most probably is an alteration of the retinal metabolism that is responsible for the retinal hyperexcitability. A psychosomatic mechanism, localized in

the diencephalon is profoundly altered by the disease process.

K. W. Ascher.

Esteban, Mario. Ocular filaria. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Dec., pp. 1097-1112.

A European girl had lived for two years in Spanish Continental Guinea. Seven years after her return to Spain she began to complain of pricking sensation of her left lower lid and something moving beneath it. A small tumor mass, which changed its shape and position was found. When the patient was operated on in novocaine anesthesia an adult female *Filaria Loa* was found and removed. In the specimen of blood many microfilarias of *Filaria Loa* were found. (6 illustrations.)

J. Wesley McKinney.

Foss, Björn. Is there a K avitaminosis in hemorrhages after intraocular operations? *Acta Ophth.*, 1941, v. 19, pt. 1, pp. 15-24.

The prothrombin concentration of the blood, using Nygard's modification of Quick's method, was determined in 54 patients with cataract, glaucoma, retinal hemorrhage, thrombosis of the central retinal vein, right sided hemianopsia, iritis with hyphemia, and thrombopenia. In 12 of 48 patients there was immediate or delayed post-operative bleeding. An analysis of the prothrombin concentrations, does not indicate that a vitamin K deficiency was a factor in these hemorrhages. One patient with cataract and sprue was found to have a deficiency of prothrombin, and was given 20 mgm. of vitamin K intramuscularly before the operation; the operation was then performed without hemorrhage. (4 tables.)

Ray K. Daily.

García Miranda, A. **Ocular diabetes.** Arch. de la Soc. Oft. Hisp.-Amer., 1945, v. 5, Dec., pp. 1041-1092.

The author reviews the different effects of the diabetic process in the eye, giving the greatest importance to the retina and the crystalline lens. Statistics do not agree as to the percentage of lesions in the eyes which probably result from other causes, mainly renal or vascular diseases. (4 illustrations.)

J. Wesley McKinney.

Gordon, D. M. **Ocular sporotrichosis.** Arch. of Ophth., 1947, v. 37, Jan., pp. 56-72.

Forty-eight cases of ocular sporotrichosis have been reported in the world literature, including the case reported in this paper. Apparently in 34 of these cases the ocular disease was primary and in 15 secondary to involvement elsewhere in the body.

The cases are distributed anatomically as follows: lids, 17; conjunctiva, 10; lacrimal sac, 2; conjunctiva and lacrimal apparatus, 1; brow, 1; intra-ocular, 5; orbit and lids, 5; cornea, 3; limbus, 1; uveal tract (without other lesions), 1, and lacrimal canal, 1.

Of the 48 reported cases, 10 have occurred in the United States and the majority of the remainder in France. (60 references.) R. W. Danielson.

Harrington, D. O. **Ocular manifestations of psychosomatic disorders.** Jour. Amer. Med. Assoc., 1947, v. 133, March 8, pp. 669-674.

Few ophthalmologists seem to be aware of the role played by emotion in the production of discharge from the autonomic nervous system and the profound vasomotor disturbance produced. Mental conflict and emotional disturbances such as tension, anxiety, embarrassment, irritation, fear, anger, rebel-

lion, inadequacy, insecurity, humiliation, grief, depression, despair, and excitement may be the causative factor in amauroses fugax, migraine neuro-circulatory asthenia, central angiospastic retinopathy, Raynaud's disease, glaucoma, and ocular hysteria in a susceptible individual.

Irwin E. Gaynon.

Koutseff, A. **Premenopausal oculo-palpebral syndrome.** Ann. d'Ocul., 1946, v. 179, July, pp. 389-398.

The complete syndrome consists of palpebral edema, ocular chemosis, vascular hypertension, ocular hypertension, concentric contraction of the fields, and transient myopia. Two cases are described. In the first patient these symptoms practically always became worse on the second day of menstruation. Following treatment with folliculine, a female sex hormone, the condition greatly improved. In the other patient, both eyes had been operated on for glaucoma; the ocular symptoms were similar to those in the first patient. The syndrome is similar to that observed in eclampsia and involves malfunction of the pituitary and adrenal glands.

Chas. A. Bahn.

Krause, A. C. **Congenital encephalo-ophthalmic dysplasia.** Arch. of Ophth., 1946, v. 36, Oct., pp. 387-444.

This is a detailed presentation of a clinical entity that has been described previously in part but not as a complete syndrome. The disease is characterized by retinal and cerebral hypoplasia and hyperplasia. The ocular changes may include microphthalmos, malformations of the retina, choroid, and optic nerve, retinal dysplasia, retinal glial membranes, cones and septums and persistent remains of the hyaloid artery. Other effects are ret-

inal atrophy, gliosis, fibrosis, intra-ocular hemorrhages and exudates, secondary glaucoma, atrophy of the iris, anterior and posterior synechias, cystitic membranes, choroidal and scleral atrophy, and cataracts.

The cerebral dysplasia is shown by the heterotopias and the hyperplasia, hypoplasia, and aplasia of the cerebrum and cerebellum. The secondary effects are the hydrocephalus, arising from the cerebral and arachnoidal dysplasia, and the microcephaly resulting from the cerebral and cerebellar agenesis.

Eighteen cases of this syndrome are described. The disease was more commonly found in premature infants and in single infants of a multiple birth. The common neurologic signs were mental retardation, microcephalus, and hydrocephalus. In some cases the brain showed cerebral and cerebellar hyperplasia, hypoplasia and agenesis, heterotopias, and internal hydrocephalus. Clinically, the ocular disease rarely occurred without neurologic signs of involvement of the brain when the child was examined after the age of four years. The ocular signs were loss of vision, ptosis, enophthalmos, microphthalmos, strabismus, retinal detachment, postlental masses, retinal atrophy, gliosis, recurrent retinal and vitreous hemorrhages, anterior and posterior synechias, secondary glaucoma and cataract. No method of treatment was found to prevent or to cure the disease.

John C. Long.

Lauda, E. Findings and treatment in Reiter's syndrome. *Wien. Klin. Wchnschr.*, 1946, v. 58, pp. 55-56. (See Section 5, Conjunctiva.)

Leoz de la Fuente, G. Ocular pemphigus. *Arch de la Soc. Oft. Hisp.-Amer.*, 1945, v. 5, Dec., pp. 1113-1121.

The author reports a case of ocular pemphigus in a man, sixty years of age who showed bilateral pseudoptosis, total retraction of the conjunctiva and complete disappearance of the cul-de-sac, and photophobia without lacrimation. The patient's corneas were clear. The man had five plaques of pemphigus on the mucosa of the nose. (5 illustrations.)

J. Wesley McKinney.

Maestro, Tullio. Polyradiculoneuritis with albumino-cytological dissociation (Guillain-Barre's syndrome) with involvement of ocular nerves. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, May-June, pp. 153-173.

The author observed two cases of this syndrome. In one patient there was bilateral involvement of the third and sixth nerves, and unilateral facial nerve involvement; in the second patient, there was a bilateral involvement of the third and of the sixth nerve and a unilateral involvement of the fourth, the sensory portion of the fifth, and the cervical sympathetic nerve. The increase in albumin in the cerebrospinal fluid without increase of its cell content can be explained by absence of inflammation while congestion and edema are present. Therapy consisted in administration of antidiphtheria serum, artificial fever, autohemotherapy, B vitamin, salicylate of sodium, and repeated lumbar punctures. Prognosis is favorable. The first description of this syndrome was published by Guillain, Barre, and Strohl, in 1916.

K. W. Ascher.

Rubino, A. The uveal-meningitic syndrome. *Riv. Oto-Neuro-Oft.*, 1946, v. 21, March-April, pp. 73-84. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Santoni, Armando. **Tuberculous bacillemia and its importance in tuberculous infections of the eye.** Arch. di Ottal., 1946, v. 50, May-June, pp. 97-137.

Hemoculture according to the method of Lowenstein was carried out (often several times) in 15 patients with iridocyclitis, the tuberculous nature of which was either fairly certain or quite probable. All but one culture was negative. In four patients with iridocyclitis and in one with papiloretinitis which were almost certainly sympathetic, the cultures were negative. In two patients with tuberculosis of the conjunctiva and in one with tuberculoma of the epibulbar tissue and Pott's disease in whom the organism could be isolated from the conjunctiva, blood cultures were repeatedly negative. Cultures were also negative in one patient with sclerokeratitis associated with tuberculous arthritis of the knee, in two with retinal periphlebitis, and in several with recurrent vitreous hemorrhage, heterochromia of the iris (Fuchs type), and post-traumatic uveitis.

Although blood cultures are not a diagnostic aid and the diagnosis of tuberculous lesions of the eye must still be clinical, these results add emphasis to the theories of Lowenstein and Meller as to method of production of ocular lesions of tuberculous origin. It has been shown by Baumgarten and Weichselbaum that tubercle bacilli can be present in tissues for some time in an inactive state. It is possible that reactivation of their virulence can be brought on by the renewed presence of toxins or lowered resistance, in previously sensitized tissues. Negative cultures can also be explained on the basis of the work by Mazzetti and his collaborators who showed that the bacilli of artificially produced bacille-

mia disappeared in direct ratio to the resistance of the animal to the infection.

Francis P. Guida.

Talbot, H. **Ocular lesions in internees at a civilian internment camp at Hong Kong.** Brit. Jour. Ophth., 1946, v. 30, Nov., pp. 688-692.

Of 278 internees who presented themselves to the camp clinic complaining of ocular symptoms, 82 percent had appreciable contraction of the visual field. This constriction often was quite severe. Many patients had a marked pallor of the disc, and chronic conjunctivitis was very common. They complained of headache, temporary loss of vision, flickering vision, night blindness, glare, and eye strain. These signs and symptoms were unmistakably due to malnutrition and were found to be irremediable.

Morris Kaplan.

Tassman, I. S. **Ocular changes in the blood dyscrasias.** Arch. of Ophth., 1947, v. 37, Jan., pp. 42-55.

A resumé of the eye findings in these dyscrasias is given as well as case reports of erythrocytosis, pernicious anemia, and splenic anemia.

R. W. Danielson.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Chance, Burton. **Exposure and fixation of the eye in the early days of cataract extraction.** Arch. of Ophth., 1946, v. 36, Oct., pp. 484-497.

This is an interesting paper on the early use of speculae and various fixation devices during cataract extraction. Numerous instruments are illustrated.

John C. Long.

James, R. R. **Ophthalmology in lectures of a century ago.** *Brit. Jour. Ophth.*, 1946, v. 30, Nov., pp. 658-659.

A few ophthalmic extracts are given from a volume of lectures by Abernethy on anatomy, surgery and pathology which were published 115 years ago. Several references are made to ocular tumors and to couching of cataracts.

Morris Kaplan.

Kuhn, H. S. **Industrial ophthalmology.** *Jour. Am. Med. Assoc.*, 1946, v. 132, Nov. 30, pp. 772-777.

The term "industrial ophthalmology" is considered obsolete, the more correct one is "occupational ophthalmology." Educational opportunities for ophthalmologists interested in this work are lacking at present but industry will demand the services of ophthalmologists.

Visual mass testing techniques are described. They are considered valuable in that important visual data such as distance and near acuity, with and without correction, distance and near phorias, distance and near stereopsis, and color appreciation are secured and recorded for each employee. The tests are not thought of as eye examinations but are placed in the category of aptitude examinations. The results guide the applicant to the proper job for him and lead others to the ophthalmologist for corrective care. The various instruments used are briefly described.

Relationship between management and the physician requires a definite understanding of what the employer can gain, as well as his responsibilities to his employees.

The author expresses an earnest desire that more ophthalmologists will become interested in occupational ophthalmology.

Francis M. Crage.

Luc, Jan. **Plastic restoration of upper lid and socket.** *Brit. Jour. Ophth.*, 1946, v. 30, Nov., pp. 665-668.

On a shrunken socket a modified Esser's plastic repair was accomplished with good result. A skin graft from the arm was folded around a dental mold and sutured into the opened socket. It healed without contracture.

Morris Kaplan.

Rutherford, C. W. **Gerontology and the eye, with some remarks on old age.** *J. Indiana St. Med. Assn.*, 1946, v. 39, May, pp. 209-212.

The ocular characteristics of old age arise from two related processes, namely, histologic alterations in the vascular tissues, and deficiency in the fat soluble vitamins. Degenerative senile processes in the cornea, iris, lens, vitreous, retina, choroid, optic nerve, eyelids, eye muscles are described.

Several suggestions for the alleviation of ocular symptoms in senile patients are made. A brief paragraph tells what the state of Indiana is doing to help the senile patient. It is the responsibility of physicians to treat the aged patient just as much as to treat the infant or the young adult.

John B. Hitz.

Ten Doesschate, G. **Some historical notes on spectacles and on beryllus.** *Brit. Jour. Ophth.*, 1946, v. 30, Nov., pp. 660-664.

A short discussion is presented of the origin of spectacles and their association with beryllus with which term the word spectacles is associated in many foreign languages. Beryl is a precious stone family that includes the emerald and aquamarine and through which magnification might have first been noted. In addition the beryl was

supposed to have possessed some mystic curative power. Morris Kaplan.

Velter, Edmond. *Ophthalmology and neurology in France from 1939 to 1945*. Arch. Chilenos de Oft., 1946, v. 2, Jan.-Feb., pp. 7-10.

The article, which is in French, is preceded by a full-page portrait of the author.

Very briefly the writer mentions a considerable number of literary contributions to these general fields of medicine which were presented to different societies during the war period. He comments that "the conditions created by mobilization and the occupation caused a dispersion of the hospital personnel and that of the laboratories, to which dispersion was added the impossibility of obtaining apparatus, instruments, chemical products and dyes, laboratory animals and their food. Limitations as to gas and electricity rendered impossible the functioning of a great part of the apparatus, especially incubators; and lack of heating made the institutions uninhabitable during the long winter months."

W. H. Crisp.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Druault, A., and Druault, S. The eyes of the new born. Ann. d'Ocul., 1946, v. 179, July, pp. 375-388.

At birth the diameter of the normal eye is 17 to 18 mm. The cornea is relatively large, 9 to 10 mm. in diameter. The choroid is relatively thick and the ciliary body is not well developed. The optic nerve fibers are myelinated. The lacrimal apparatus is not well developed and a diaphragm frequently exists in the sac at birth. Crying does not occur until about the sixth week of infant life. The growth of the orbit

depends upon the completeness of its contents; therefore enucleation in infancy prevents full development of the face. The weight of the eye at birth is about 2.29 grams which is one-third of that of the adult eye. At birth there is a fetal structure, the scleral protuberance of Von Ammon, which corresponds to the macula. During the eighth month of fetal life the cornea is opaque, but at birth it is entirely transparent. Descemet's membrane does not form until the sixth month after birth. At birth the sclera is bluish because it is thin and translucent. Because of the absence of epithelial pigment in the iris at birth, most children are born with blue eyes, though in some strongly pigmented races the iris may be a very dark brown. The crypts of the iris are not well formed until after the first year. The pupillary membrane of Wachendorf is absorbed during the eighth month of fetal life. Pupillary contractions occur during the fifth month of fetal life. Accurate vision is questionable until at the age of three months when the myelination of the optic nerve is complete. The pigmentation of the suprachoroid begins at birth and is not complete for one year. The number of rods and cones does not increase with the increasing development and size of the eye. No mitoses occur in the retina after the fourth month of fetal life. The papilla of the newborn is more deeply colored than in adult life, but has the same individual differences. The lens, at birth, has about one-half the adult thickness. The posterior star is more developed than the anterior and zonular fibers are apparently more numerous than in the adult. The hyaloid artery disappears before the ninth month of fetal life. The canal of Cloquet is a condensation of vitreous tissue around the hyaloid vessels.

Chas. A. Bahn.

PAN-AMERICAN NOTES

Edited by M. URIBE TRONCOSO, M.D.
500 West End Avenue, New York 24

Communications should reach the editor by the 12th of the month

III PAN-AMERICAN CONGRESS OF OPHTHALMOLOGY

The date of the meetings of this Congress has been advanced by the committee in Havana, Cuba, due to difficulties to obtain reservations in the hotels at a later date in the season. The meetings will be held from January 4 to 10, 1948. Arrangements are being made with travel agencies to offer transportation to Havana either by plane, or railroad and boats. To obtain reservations in hotels, members are advised to write as soon as possible to Dr. Tomas Yanes, P.O. Box 970, Havana, Cuba.

The agenda of the III Congress will be: (1) Presentation of official and of free scientific papers. (2) Sessions pertaining to research. (3) Scientific and commercial exhibits. (4) Courses of instruction. (5) Moving picture exhibits.

Official papers; that is, papers read in representation of an institution, should take not more than 20 minutes, including time for screen projections, and they should be accompanied by a summary of not more than 600 words.

Dr. Thomas D. Allen, 122 South Michigan Avenue, Chicago 3, Illinois, U.S.A., is in charge of the courses of instruction; and Dr. Gilberto Cepero, Calle L No. 353, Vedado, Habana, Cuba, of the moving picture exhibits.

Official papers should be mailed on or before August 23, 1947.

MEXICAN OPHTHALMOLOGICAL SOCIETY

This society, formerly combined with the Otolaryngological Association, has separated in two different branches. New elections were held for the board of the Ophthalmological Society, with the following results: president, Dr. F. Palomino Dena; secretary, Dr. Teofilo Agundis (Lucerna, 63, Mexico D.F.). Meetings will be held monthly. The society's journal will revert to its original name: *Anales de la Sociedad Mexicana de Oftalmologia*, and will be under an editor-in-chief, Dr. M. Puig Solanes, and a large committee on publication which includes many representative members. It will appear every two months.

ASSOCIATION FOR THE PREVENTION OF BLINDNESS IN MEXICO

This association will hold its third annual Scientific Week from August 11 to 16, 1947, in Mexico City. Contributions to the meeting from American ophthalmologists will be welcomed and should reach the secretary of the associa-

tion, Dr. Daniel Silva (Gomez Farias 19) not later than July 10, 1947. The papers should be original, not published before, and accompanied by a short abstract.

NATIONAL INSTITUTE OF OPHTHALMOLOGY IN MEXICO

An official decree of the President of the Republic has recently created a "Patronato" or board of trustees to be in charge of the building, equipment, and management of an "Instituto Nacional de Oftalmologia" which will be devoted to the treatment of patients with eye diseases, and to research work on ophthalmology and teaching, both for undergraduate and postgraduate students. The latter will be in connection with the National University of Mexico. Five members of the Patronato will be private, outstanding business and professional men and the sixth, ex officio member, will be the Secretary of Health and Public Welfare in the cabinet of the President.

The Federal Government has deeded to the trustees the necessary ground space for the construction of three units: an ophthalmological hospital of about 100 beds, an outdoor department and dispensary, and one building for research laboratories and teaching purposes. The trustees have already received the grounds and have started the foundations of the hospital. This is located near the magnificent Instituto Nacional de Cardiologia, recently opened and now in successful operation. The Institute of Ophthalmology will be of the same architectural style as the group of special hospitals near the General Hospital of Mexico City.

The trustees have already established several fellowships in ophthalmology for promising young Mexican physicians to study in this country and England for one year and then to become members of the medical staff of the Institute.

CHILEAN OPHTHALMOLOGICAL SOCIETY

This society has established a postgraduate course of ophthalmology which will last two years and of which at least one year will be devoted to internship in an ophthalmologic service. The basic subjects, anatomy, microscopic anatomy, embryology, physiology, pathology, bacteriology, and so forth, will be taught by members of the society under a director who shall be professor of the university. A certificate of attendance will be given to students taking the complete course.

V. BRAZILIAN CONGRESS OF OPHTHALMOLOGY

This congress met at the city of Salvador, Baia, from June 28, to July 2, 1946, and was presided over by the Secretary of Health and Education of Brazil. Three official subjects were presented: (1) Vision Requirements for Motor Drivers, by Dr. Pereira Gomes of Sao Paulo. (2) Abiopathic Diseases of the Macular Re-

gion, by Prof. Jorge Malbran and Prof. Carlos S. Damel of Buenos Aires. (3) Vitamins in Ophthalmology, by Dr. Joviano Rezende, Dr. Geraldo Queiroga, and Dr. Heitor Marback. (4) Glaucoma, by Dr. Renato de Toledo, Dr. Jacques Tupinamba, and Dr. Rui Rolim. Several surgical demonstrations were held at the hospitals.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. Ross Epting Anderson, Jackson, Mississippi, died January 15, 1947, aged 48 years.

Dr. George Freiman, Brooklyn, New York, died January 3, 1947, aged 53 years.

Dr. John Marvin Ingersoll, Miami, Florida, died January 16, 1947, aged 77 years.

Dr. Thomas Otis Klingner, Springfield, Missouri, died January 7, 1947, aged 72 years.

Dr. James Orville MacDonald, New York, New York, died January 13, 1947, aged 54 years.

Dr. Edward Rodgers Neep, Colorado Springs, Colorado, died November 21, 1946, aged 79 years.

Dr. Albert Ernest Rector, Appleton, Wisconsin, died January 13, 1947, aged 73 years.

MISCELLANEOUS

N.S.P.B. SCHOLARSHIPS

Nine one-year scholarships of \$1,000 each have been established by the National Society for the Prevention of Blindness for students who wish to qualify themselves for work in sight conservation and the prevention of blindness. Hospitals, public and private blindness-prevention agencies, and various organizations offering medical-care programs now have positions waiting to be filled. Applications for the scholarships, which are now open, may be obtained by writing the National Society for the Prevention of Blindness, 1790 Broadway, New York 19.

DELTA GAMMA SCHOLARSHIPS

Information on basic qualifications for the Delta Gamma scholarships for students interested in professional education in blindness prevention and sight conservation may be obtained from Mrs. Richard P. Miller, 39 West Jefferson Road, Pittsford, New York.

UNIVERSITY OF GLASGOW MEETINGS

During April, a series of meetings was held in the Department of Ophthalmology of the

University of Glasgow, Scotland. On April 9th, Prof. W. J. B. Riddell spoke on "American Gleanings." Dr. R. Leishman was the speaker for the April 16th meeting. His subject was "Chemical Injuries of the Cornea." "Industrial Cataract" was the subject presented by Dr. J. D. Fraser on April 23rd, and on April 30th, Dr. A. Mellick spoke on "Heterophoria."

SCHOLARSHIPS HONOR DR. CARY

At the celebration in honor of the 75th birthday of Dr. Edward Henry Cary of Dallas, Texas, the sum of \$20,000 for scholarships in his name was presented to Dr. Cary by Pres. Umphrey Lee of Southern Methodist University, Dallas.

LECTURES AT MANHATTAN HOSPITAL

During the first two weeks in April, Dr. Arthur Linksz concluded his series of lectures on "Physiological and Geometrical Optics," at the Manhattan Eye, Ear, and Throat Hospital, New York. On April 22nd, Dr. David H. Webster lectured on "Cataract Surgery." Dr. Guernsey Frey spoke on "Office Management and Routine," on April 24th. "Injuries of the Globe" was the subject of the lecture by Dr. Frank C. Keil on April 29th.

SOCIETIES

LOUISIANA-MISSISSIPPI MEETING

The Louisiana-Mississippi Ophthalmological and Otolaryngological Society held its annual meeting at the Buena Vista Hotel, Biloxi, Mississippi, on May 5th. Dr. Peter C. Kronfeld of Chicago spoke on "Newer Trends in the Treatment of Ocular Diseases." "Allergic Problems Seen by the Ophthalmologist and Otolaryngologist," was the subject of an address by Dr. Ralph Bowen, Houston, Texas. The J. Raymond Hume Memorial Address was given by Dr. Henry L. Williams of Rochester, Minnesota, whose subject was "Meniere's Disease." Dr. Samuel Fomon, New York, spoke on "The Rhinoplastic Operation and the Restoration of Nasal Function."

READING SOCIETY ATTENDS CLINICS

Temple University Hospital, Philadelphia, was the March 19th meeting place for the Eye, Ear, Nose, and Throat Society of Reading, Pennsylvania. Wet and dry clinics were conducted by Dr. Matthew S. Ersner.

SPEAKS AT MILWAUKEE MEETING

At the regular meeting of the Milwaukee Oto-Ophthalmic Society on March 25th, Dr. Derrick Vail, professor of ophthalmology, Northwestern University Medical School, Chicago, spoke on "Some Clinical Aspects of the Blood Supply of the Optic Nerve."

CLEVELAND GUEST SPEAKER

The guest speaker at the March dinner meeting of the Cleveland Ophthalmological Club was Dr. Thomas D. Allen, associate professor of ophthalmology at Rush Medical School, Chicago. The subject of his address was "The Value of a Complete Ophthalmological Examination."

PENNSYLVANIA ACADEMY MEETING

Dr. William L. Benedict of the Mayo Clinic, Rochester, Minnesota, was guest of honor at the annual meeting of the Pennsylvania Academy of Ophthalmology and Otolaryngology in Harrisburg on April 26th and 27th. "Tumors of the Orbit," and "Medical Societies and Medical Education," were the subjects of the two papers given by Dr. Benedict. Dr. Francis Heed Adler of Philadelphia, spoke on "Problems in the Diagnosis and Treatment of Chronic Simple Glaucoma," and Dr. Charles Kutscher of Pittsburgh, spoke on "Contusions of the Eyeball." Other speakers were: Dr. Thomas B. McCollough, Dr. Albert P. Seltzer, and Dr. LeRoy Polvogt.

CINCINNATI SOCIETY REVIVED

At its first meeting since November, 1928, the revived Cincinnati Ophthalmological Club had as guest speaker, on March 14th, Dr. A. D. Ruedemann of the Cleveland Clinic, who spoke on "Beta Radiation."

ANNOUNCEMENTS

OXFORD OPHTHALMOLOGICAL CONGRESS

On July 3, 4, and 5, 1947, the Oxford Ophthalmological Congress will convene at the Department of Human Anatomy, Oxford. The congress will open with a discussion on "The Contracted Socket," which will be led by Prof. T. Pomfret Kilner and Mr. H. B. Stallard. The Doyne Memorial Lecture will be delivered by Prof. L. S. Stone of Yale University, and will be entitled "Return of Vision and Functional Polarization in the Retinae of Transplanted Eyes."

EXAMINATIONS FOR TECHNICIANS

American Orthoptic Council examinations will be held in September and October, 1947. Written examinations will be given in various cities on Friday, September 12th. Only those passing the written examinations will be permitted to take the oral and practical tests to be given in Chicago, October 11th. Applications on official forms must be received before July 1, 1947. Address the American Orthoptic Council, 23 East 79th Street, New York 21.

WILDER MEMORIAL LECTURE

The third William Hamlin Wilder Memorial Lecture of the Institute of Medicine of Chicago will be delivered by Dr. John Q. Griffith, Jr., Laboratory for the Study of Hypertension, Philadelphia, on Friday evening, May 23rd, at the Palmer House. His subject will be, "Rutin: A Therapy for the Hemorrhagic Complications of Hypertension."

RESEARCH ASSOCIATION PROGRAM

The Association for Research in Ophthalmology, Inc., will convene at the Atlantic City Junior High School auditorium, Ohio and Pacific Avenues, Atlantic City, New Jersey, at 8:30 A.M. on Tuesday, June 10th. The program to be given follows:

Morning Session

(8:30 A.M. to 12 M.)

1. Bilateral Granulomatous Uveitis from the Use of Horse Serum in Rabbits.
T. F. Schlaegel, Jr., M.D., Department of Ophthalmology, Indiana University Medical Center, Indianapolis.
2. Stimulation of Corneal Epithelization with Local Application of Erythrocytes.
Frank W. Newell, M.D., Department of Ophthalmology, Northwestern University Medical School, Chicago.
3. The Effect of Di-isopropyl Fluorophosphate on the Capillaries of the Anterior Segment of the Eye.
Ludwig von Sallmann, M.D., College of Physicians and Surgeons, Columbia University, New York.
4. Transfer of Ascorbic Acid and Related Compounds Across the Blood-Aqueous Barrier.
V. Everett Kinsey, Ph.D., Howe Laboratory, Boston.
5. Acute Reversible Cataract in Chicken Due to Various Nitro-Compounds.
Wilhelm Buschke, M.D., Wilmer Ophthalmological Institute, Baltimore.
6. Virus Studies in Lymphomatoid Disease of the Ocular Adnexa.
Alson E. Braley, M.D., Assistant Professor of Ophthalmology, College of Physi-

cians and Surgeons, Columbia University, New York; Rose Alexander, M.S., College of Physicians and Surgeons, Columbia University, New York.

Executive Session

(1:15 P.M.)

7. Cyanide Inhibition of Corneal Respiration. W. A. Robbie, Ph.D., P. J. Leinfelder, M.D., T. D. Duane, M.D., University Hospitals, Iowa City, Iowa.
8. Ocular Effects of Tridione. Louise L. Sloan, Ph.D., Anita Peek Gilger, M.D., Wilmer Ophthalmological Institute of Johns Hopkins Hospital, Baltimore.
9. The Reaction of Various Types of Fat Transplanted into the Orbit of Guinea Pigs Prior to the Development of Exophthalmos. George K. Smelzer, Ph.D., College of Physicians and Surgeons, Columbia University, New York.
10. Conjunctivitis with Membrane Formation. Michael J. Hogan, M.D., Division of Ophthalmology, University of California Medical School, San Francisco.
11. Studies of the Physiology of the Eye Using Tracer Substances. Walter S. Wilde, Ph.D., Roy S. Scholz, M.D., Dean B. Cowie, Ph.D., Carnegie Institute of Washington, Department of Embryology, Baltimore; Wilmer Oph-

thalmological Institute of Johns Hopkins University and Hospital, Baltimore; and Carnegie Institute of Washington, Department of Terrestrial Magnetism, Washington, D.C.

12. Observations on Pityrosporum Ovale in Seborrheic Blepharitis and Conjunctivitis. J. S. Gots, M.D., Phillips Thygeson, M.D.; M. Waisman, M.D., University of Pennsylvania, Philadelphia; University of California, San Francisco; and Tampa, Florida.

Reception

(5:30 P.M.)

Reception for Participants in the Program at the Marlborough-Blenheim Hotel.

PERSONALS

Dr. Frank W. Newell is now located at 30 North Michigan Avenue, Suite 1618, Chicago 2, Illinois.

Dr. Samuel M. Bloom has his offices at 121 East 60th Street, New York 22, New York.

Dr. Joseph I. Pascal of New York gave a series of lectures for the residents and internes of the Department of Ophthalmology, U. S. Naval Hospital, St. Albans, New York, during March. The subjects discussed by Dr. Pascal were: "A Study of Ocular Torsions," "Memory Aids in Physiological Optics," and "The How and Why of Cross-Cylinder Tests."

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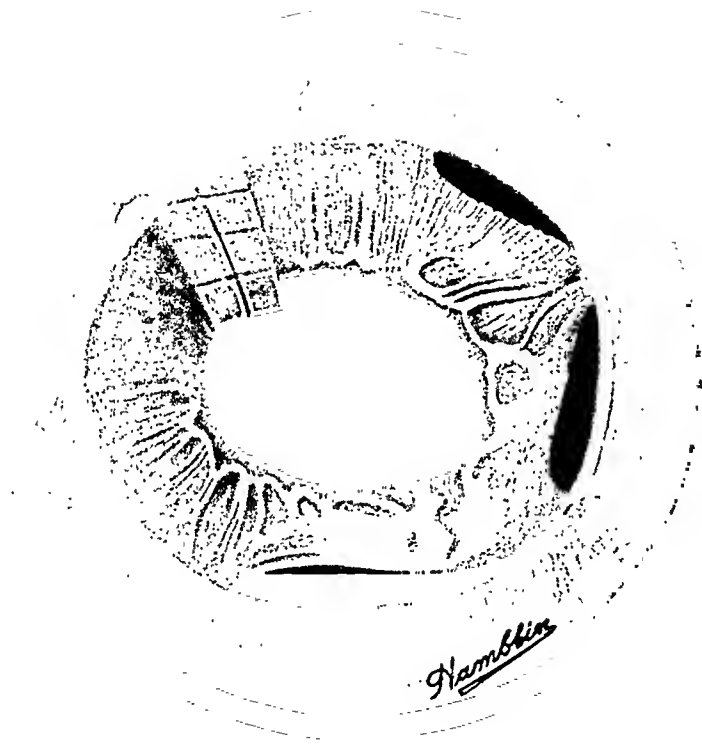


FIG. 1 (NEWELL). APPEARANCE OF THE EYE SIX WEEKS AFTER THE SECOND PROCEDURE.

EXTENSIVE TRAUMATIC IRIDODIALYSIS WITH REPAIR*

FRANK W. NEWELL, M.D.

Chicago, Illinois

Separation of the ciliary border of the iris from its attachment may occur spontaneously in atrophy of the iris root or may follow blunt ocular contusions in which the iridodialysis is frequently associated with hyphemia, zonular rupture, subluxation of the lens, cataract, and ciliary-body detachment followed by atrophy. The traumatic type may vary in extent from a small defect visible only with a slitlamp to a detachment of the entire ciliary border with the iris falling to the bottom of the anterior chamber and visible as a small gray ball of tissue.

Small defects, those covered by the lids, and asymptomatic cases do not require operative treatment; whereas, large defects causing monocular diplopia, dazzling of vision, and photophobia should be corrected surgically if the concomitant ocular pathologic processes do not overshadow the iridodialysis. Since cases of large separation unaccompanied by other major pathologic conditions of the eye are relatively rare, this case is presented to illustrate a simple method of correction whereby gratifying functional and cosmetic results were obtained.

CASE REPORT

When the patient, a 24-year-old white soldier, was admitted to the 108th General (U.S.) Hospital, December 2, 1943,

* From the Department of Ophthalmology, Northwestern University Medical School.

he stated that 48 hours previously he had been struck in the left eye by a small branch of a tree which caused immediate and severe ocular pain. He was immediately hospitalized, 1-percent atropine solution was instilled in the eye, and a binocular bandage was applied. Vision, two days after the injury, was 20/20 in the right eye; and 20/50 in the left eye. It could not be improved with correction. The only apparent damage to the left eye was a separation of the entire nasal attachment of the iris extending from the 10- to the 7-o'clock meridian. The iris was drawn toward the intact temporal attachment, and only the temporal portion of the pupil was visible. The free iris border appeared to float in the anterior chamber, but it was not possible to change its position by gravity. Intraocular pressure was 18 mm. Hg (Schiotz-Gradle); peripheral and central visual fields were normal; the cornea and conjunctiva did not stain with fluorescein; and the fundus was normal. A slight hyphemia was present immediately after injury, according to the station hospital record, but this had absorbed without residue prior to admission. The chief complaint was dazzling and photophobia in bright light which was not relieved with tinted lenses. Treatment with 1-percent atropine solution, instilled locally four times daily, gave no evidence of response.

On December 8, 1943, the first of a

two-stage operation was performed with O'Brien akinesia and retrobulbar procaine-hydrochloride and topical pontocaine anesthesia. A small conjunctival flap was prepared and a corneoscleral suture was placed at the limbus at the 2-o'clock meridian in such a manner that it could be tied over the cornea instead of the sclera. A small keratome incision was made between loops of the suture, and the peripheral border of the iris was grasped with an iris hook and drawn into the wound. With an assistant drawing up the suture while the hook was simultaneously disengaged from the iris, it was possible to incarcerate a small shred of tissue in the wound without prolapse. The previously prepared conjunctival flap was then drawn over the wound; the episcleral sutures were tied; and pilocarpine solution instilled. A binocular dressing was applied.

Convalescence was uneventful and all sutures were removed on the seventh postoperative day. The iridodialysis was reduced to about one half extending from the 2- to the 7-o'clock meridian.

On January 14, 1944, a similar procedure was performed with the keratome incision at the 5-o'clock meridian, with immediate restoration of a central round pupil and an anterior chamber of normal appearance. Three small peripheral defects were present between the areas of attachment but, as they gave rise to no symptoms, further surgery was considered inadvisable.

Vision was 20/30 in the treated eye, improved to 20/20 with a $-0.75D.$ sph. $\odot +1.00D.$ cyl. ax. 130° . Intraocular pressure was 22 mm. Hg (Schiotz-Gradle). The peripheral field, central field, and accommodation were normal. The pupillary reaction to light was present only in the normally attached segment of the iris but the response of the pupil to miotics and mydriatics appeared nor-

mal. In April, 1945, 16 months after the second operation, in response to a questionnaire the patient replied that corrected vision was 20/20 and J1, the iris was still in position and no further hospitalization had been required.

DISCUSSION

Reattachment of an iridodialysis occasionally occurs spontaneously even in the absence of active ocular therapy. In an early case (1830), Lawrence¹ reported recovery occurring after venesection. Vigorous atropinization of the injured eye has been recommended by Shedlow² and Brown³ who each reported a case in which this treatment resulted in recovery. Duane⁴ considered atropine unnecessary and attributed the fortuitous outcome to recurrent hemorrhages, with the formation of a fibrinous exudate which bound the iris in place. Such a result must be uncommon, however, for Wagemann,⁵ in a comprehensive review of the subject, found only a few cases in which medical treatment was efficacious.

Surgical correction of iridodialysis may be conveniently divided into three main classes: (1) Iridectomy or iridotomy. (2) Reattachment to a fresh surface within the anterior chamber. (3) Incarceration of the iris in a corneoscleral wound.

Middlemore⁶ suggested converting the two pupils into one by dividing the intervening portion of iris, but it is not clear whether he ever performed such an operation. Würdemann,⁷ in at least one case, performed an iridectomy to remove a band of iris stretching across the visual axis and recommended the procedure. Recent publications have not mentioned this type of surgery, and it is probable that it has been generally abandoned.

Jameson⁸ developed an ingenious method of repair in which a fine silk suture is introduced into the sclera, 2 or 3 mm.

behind the limbus, and passed into the anterior chamber. The base of the detached iris is then transfixated, and the suture passed through the cornea where the needle is removed. Through a keratome incision, a small hook then engages the suture between the iris and the cornea, drawing it through the cornea into the anterior chamber and out through the ocular wound where it is tied. The iris then reattaches at the point of contact with the sclera. In the present case, it would have been necessary to perform the maneuver a number of times since the ciliary border of the iris was so distant from the nasal limbus that it was not possible to transfix the iris by using a needle of customary size.

Incarceration of the iris in a corneoscleral wound was originally suggested by Amédée,⁹ in 1865, and the technique has been modified by a number of surgeons, the chief variation being the use of sutures between the iris and sclera as in the methods of Key¹⁰ and Spaeth.¹¹ The amount of iris incarcerated varies

from actual prolapse as in the methods of Smith¹² and Bulson,¹³ to the inclusion of only a small shred of iris tissue as recommended by Goldfelder¹⁴ and Wheeler.¹⁵

Correction of the defect in the present case was essentially the technique of the last two surgeons with the exception of the use of a corneoscleral suture, which by causing immediate closure of the wound insured incarceration of the iris and permitted full control of the amount of tissue included in the wound. Apparently the iris tends to be drawn toward its normal attachment, and actual prolapse is not a complication to be feared.

SUMMARY

A case of extensive traumatic iridodialysis is presented in which a successful functional and cosmetic result was obtained by incarceration of a shred of iris tissue in a corneoscleral wound closed by suture.

30 North Michigan Avenue (2).

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EPIDEMIC RETROBULBAR NEURITIS IN THE PHILIPPINES DURING THE JAPANESE OCCUPATION*

GEMINIANO DE OCAMPO, M.D., CARLOS V. YAMBAO, M.D., PABLO J. MAÑAGAS, M.D.,
AND CARLOS L. SEVILLA, M.D.

Manila, Philippines

This report is impelled by two recent articles in ophthalmic literature—"Nutritional Amblyopia in American Prisoners of War Liberated from the Japanese," by Bloom and others¹ and "Ocular Lesions in Internees at a Civilian Internment Camp at Hongkong," by Talbot.² Although these authors agreed on the role nutritional deficiency had in causing the ocular symptoms observed, they differed in their reports of the manifestations of disease and in their interpretations as to the site of the lesions as well as to the deficient vitamin or vitamins. This report is based on studies made on Filipinos who suffered from retrobulbar optic neuritis which occurred in epidemic proportions in the Philippines during 1942 and 1943. While our observations and interpretations may vary from those of others who have reported on the ocular manifestations of nutritional deficiency, we hope that these studies may contribute to a proper evaluation of the factor of the "soil" in the etiologic consideration of optic-nerve lesions of nutritional or other origin.

According to Fernando³ this Philippine epidemic commenced soon after the war; reached the maximum height of incidence about December, 1942, one year after the occupation; and had practically disappeared by the end of September, 1943. Although the records of the Philippine General Hospital show that 451 cases of retrobulbar neuritis were diagnosed in 1942 and 1943, in contrast to 72 cases in

1940 and 1941, this report is confined to the study of 28 cases in which examination and follow-up were unusually thorough, both extremely difficult procedures at that time.

In using the Comberg slitlamp especial attention was given to retroillumination in the study of limbal vascularization. The Ferre-Rand perimeter and the Bjerrum tangent screen were used. A white-ring fixation object was found to give the most accurate records especially in mapping the bilateral central scotomas present in these cases. Ophthalmoscopy was always done under mydriasis to permit careful examination of the macula. Following the advice of Traquair,⁴ the presence of a scotoma was ruled out only by 1/2,000 white and 1/1,000 red or blue test objects. Filipino standards for visual fields and blind spot were first established before interpretations of field changes were made. Refraction was carefully checked in each case.

CASE REPORTS

Before summarizing our findings we shall cite two cases typical of the 28 cases studied.

Case 1. A woman, aged 28 years, complained of foggy vision in both eyes for one week. Positive scotoma, lacrimation, and photophobia were not present. For one month she had had angular stomatitis, and two days before she was first seen she had circumoral numbness. Her diet consisted mainly of rice and fish, meat occasionally, and vegetables rarely.

Examination showed nose, teeth, and tonsils to be normal. The Wassermann

*From the Department of Ophthalmology and Otolaryngology, College of Medicine, University of the Philippines.

test was negative. There were no helminth ova in the feces. The eyes were normal externally. Fundus and biomicroscopic examinations showed no pathologic conditions. Vision was: O.U., 20/30; with the pinhole (2 mm.), no change. Near vision was: O.D., 14/21; O.S., 14/28, made worse by use of the pinhole. There were relative central scotomas for 3/1,000 red in both eyes. There was also bilateral concentric contraction, more temporally, of the peripheral fields for form.

The patient was advised to change her diet and to take a plate of mongo (a native bean) at each meal supplemented by leafy vegetables. She also took darak (rice bran), two tablespoonfuls in a glass of water with orange (citrus mitis blanco) and sugar, 10 times a day. Three months later, vision in both eyes was normal for far and near. The scotomas had disappeared, and visual fields were normal. During the eight months this case was followed, normal vision was maintained.

Case 2. A man, aged 26 years, had progressive blurring of vision and photophobia in the right eye for two months before he was first seen. Three weeks later the left eye showed the same symptoms. No lacrimation, pain, positive scotoma, nor numbness of the extremities were present. Three weeks before visual symptoms appeared, the patient had bilateral, angular stomatitis. The diet was poor, especially in vitamin B.

Examination showed the Wassermann test to be negative. No helminth ova were present in the feces. Teeth, nose, and tonsils were normal. The eyes showed no external abnormality. The fundi were normal. Biomicroscopy revealed a clear cornea, marked limbal pigmentation, and practically normal limbal vascularization in both eyes. Vision was: O.U., 20/50 and 14/42, unchanged by use of the pinhole. There was no manifest refractive error. There was a large bilateral cen-

trocecal scotoma for 1/1,000 white. Visual fields were normal.

The patient in this case was also advised to change his diet. He also began taking "tiki tiki" (rice bran extract) a tablespoonful, three times a day. A week later, his vision had deteriorated to: O.D., 20/160, 14/89; and O.S., 20/50, 14/56. After that, however, it continued to improve. After one month, vision was: O.U., 20/20, 14/35, with very marked subjective improvement. After nine months, vision was normal for far and near and no scotoma was present.

SUMMARY OF FINDINGS

The youngest patient in the series studied was 15 years of age, and the oldest was 60 years of age. The average age was 32 years, and the majority of patients were between 20 and 30 years of age. The almost equal number of men and women (15 m.; 13 f.) belonged, generally, to the lower middle class. Although many of them were unemployed, none could be considered destitute. In private practice, this form of retrobulbar neuritis was found even among the well-to-do class.

All except one case (7) had bilateral involvement, both eyes being affected at the same time in the majority of cases. The one unilateral case was seen early when vision was only slightly impaired, 20/30 in the affected eye with a small, relative central scotoma for red. A month after she was first seen, when vision was almost normal again, this patient failed to return.

The primary complaint of all patients was a failure of vision described as similar to that observed when looking through smoke. Except in a few cases the maximum failure of vision was three or four weeks after the onset. Photophobia, which is not the same as glare blindness (Yudkin⁵) was a complaint in one third of the

cases. Five cases (17.6 percent) had laceration with either itching, redness, or smarting of the eyes. Ocular pain, mucoid discharge, dizziness, and the sensation of warmth in the eyes were observed in individual cases. Headache, generally frontal, was present in four cases. Angular blepharitis associated with angular stomatitis was noted in only one case. Bilateral positive scotoma was a complaint of only one case (10).

Angular stomatitis was present at one time or another during the course of the ocular affection in 71 percent of the cases. Symptoms referable to peripheral neuritis, such as numbness around the mouth and of the extremities and paresthesia of the toes, feet, legs, or fingers, hands, and forearm were found in one half of the cases. Glazed tongue was found in 14.7 percent and scrotal pruritis in 7.1 percent. All except one patient had a deficient diet limited to rice and fish. Some diets had a moderate supplement of vegetables, and a few had a little meat. Only slight losses of weight were shown in these cases.

Seven patients were habitual cigarette smokers, and one patient was a tuba (a native alcoholic beverage) drinker. Two patients were lactating mothers; and two had histories of diarrhea for 2 or 3 months before the onset of ocular symptoms. Two patients had a purulent urethritis and one had a gall-bladder disease.

In all except two cases, there were no external signs of pathologic conditions of the eyes. In one case there was a slightly abnormal limbal vascularization, and in another case there was an anterior polar cataract.

The vision in all cases ranged from 20/30 to 2/200 or less. In four patients vision was 20/50 or better; in two, 20/50 to 20/100; in six, 20/100 to 20/150; in two, 20/150 to 20/200. Fourteen patients, or 50 percent had vision of 20/200 or

less. The subnormal near vision present in all cases was not due to accommodative error.

With no exceptions, a scotoma was demonstrable in every case. The scotoma was absolute in 24 cases, and relative, especially to red, in four. There were 19 bilateral central scotomas, and four bilateral centrocecal scotomas. Five patients had a central scotoma in one eye and a centrocecal scotoma in the other eye. In the only unilateral case, a central scotoma was present in the involved eye. The blind spots were normal in one half of the cases. Five of these had definitely enlarged blind spots distinct from the central scotoma in both eyes; while in four cases, the enlarged blind spots merged with the central scotomas and resulted in bilateral centrocecal scotomas. In five cases, there were unilateral centrocecal scotomas with distinct central scotoma and enlarged blind spots in the other eye. We have found that without the use of a white-ring fixation object, it is easy to record a paracentral scotoma when a central scotoma is really present.

Eighteen cases (64 percent) had normal visual fields. Four had temporal contraction of 5 to 10 degrees for form in one or both eyes, and five had temporal contraction of more than 10 degrees. Nasal contraction of 10 degrees was noted in only one case, but no case showed a very marked concentric contraction as reported in the series of Talbot. It will be seen that while a central scotoma was invariably present, enlarged blind spots, distinct or merged with the central scotoma, were recorded in one half of the cases, while only one third had peripheral field changes which were mainly temporal.

Twenty cases (71.4 percent) had normal fundi. Three cases had temporal pallor of the disc, while three other cases had no abnormal change except absent foveal reflexes. Two had hazy media due

to lenticular opacity in one and epithelial corneal dystrophy (de Ocampo⁶) in the other. One had slight congestion of the disc. There were no abnormal biomicroscopic findings in 16 cases (57.1 per cent). Eight showed only moderate to marked limbal pigmentation. One had epithelial corneal dystrophy associated with abnormal limbal vascularization, while another had minimal epithelial corneal dystrophy with limbal pigmentation but no

to the changed diet. The rice bran contributed approximately 6.6 I.U. of vitamin B₁ daily. In addition to the prescribed diet and rice bran, three cases were treated with transorbital diathermy (Birch-Hirschfeld⁷) for 10 minutes daily for an average of 10 days. One case received diathermy and dietetic treatments, while another was given brewers yeast tablets in addition to the changed diet. Of the 12 patients who did not receive

TABLE 1
RESULTS OBTAINED WITH VARIOUS THERAPIES USED IN TREATING RETROBULBAR NEURITIS IN 23 PATIENTS

Treatment Given	No. of Cases	Recovered	Markedly Improved	Moderately Improved	Unchanged	Worse
Diet alone	3	1	1	1		
Diet and rice bran	7	4	1		2	
Diet, rice bran, and diathermy	3		1		1	1
Diet and diathermy	1			1		
Diet and thiamine	1		1			
Diet and brewers yeast	1	1				
Rice bran alone	2		1	1		
Diathermy alone	3		1	2		
No treatment	2			1		1
Summary	23	6 (26%)	6 (26%)	6 (26%)	3 (13%)	2 (8.7%)

vascularization. One had slight abnormal limbal vascularization but no corneal lesion, and one had arcus senilis.

Wassermann blood tests were made in 16 of these cases. All of them were negative. Feces of 5 of 11 patients showed ova of *Ascaris* and *Trichuris trichiura*.

Various forms of treatment were tried. A change of diet with the addition of beans containing around 90 international units of vitamin B₁ (per serving) plus green leafy vegetables was advised in half of the cases. Seven patients were instructed to take a suspension of rice bran with native orange and sugar in addition

any change in diet, five failed to return for sufficient follow-up. Of the remaining eight patients, two received rice bran alone; three, diathermy alone; one, thiamine chloride only (10 mg. daily for 6 days); and two, no treatment, dietetic or otherwise. The results are shown in Table 1.

It may be said, therefore, that in 78 percent of the cases, there was a change for the better and in one case (4.3 percent) even without treatment. In only two cases (8.7 percent) was the condition progressive; and one of these received no treatment at all. In three (13 percent)

the condition was stationary during the period of observation. Although the number of cases which were carefully followed during this epidemic of retrobulbar neuritis is small, it is our impression that the prognosis for the epidemic as a whole was good.

COMMENT

The diagnosis of retrobulbar neuritis was based on the demonstration of a central scotoma when the fundus was normal or essentially normal. We have not, in fact, been convinced that there is a pathologic significance in the absent foveal reflexes except when there are other fundus findings, because this condition is occasionally encountered in normal individuals. When, however, other macular changes are present, such as the stippling and abnormal reflexes found by Bloom, we consider the condition to be one of central choroidoretinopathy. When the relative scotoma for red is more prominent than that for blue, as in these cases, the condition is more likely a retrobulbar neuritis than a retinal lesion such as Talbot considered present in his cases.

We prefer the diagnosis of retrobulbar neuritis to nutritional amblyopia, which is a vague term, or to optic atrophy, because in our series of cases only 13 percent showed an appreciable pallor of the temporal disc, which is an accepted sign of retrobulbar neuritis of some standing. In fact, in a few cases the pallor had progressed to primary optic atrophy. We have called the condition epidemic retrobulbar neuritis because of its occurrence in epidemic form; however, we believe that it was not contagious nor infectious. Oguchi⁸ reported, in 1930, an epidemic of optic neuritis in Japan, axial in type with superficial keratitis, which he attributed to a deficiency of vitamin A.

It will be noted that this epidemic ret-

robulbar neuritis was not only axial but that there were also peripheral field changes in one third of the cases, and blind-spot enlargements in one half. These conditions pointed to involvement of the fibers at the periphery of the nerve as well as in and around the papillomacular bundle. The course of the disease was subacute or chronic in the majority of cases, although the prognosis was good as a whole, especially when the case was seen early, and the nutritional deficiency was sufficiently corrected. There seemed to be a tendency toward improvement even when no treatment or only vasodilator therapy—transorbital diathermy—was given.

That these patients were suffering from deficiencies not only of vitamins but also of protein, carbohydrate, fat, and so forth was beyond doubt. The deficiencies were not so extended, however, as in the cases of those Americans and British reported by Bloom and Talbot, since loss of weight was not marked. The fact that these patients improved or recovered when they received better diets and additional amounts of vitamin B₁ or vitamin-B complex proved only that whatever other etiologic factors were involved, vitamin-B complex and vitamin B₁, which act as catalysts, and vitamin A played a part. Burn⁹ found histologic evidences of a high incidence of nerve degenerative changes among Filipinos even before the war. The epidemic subsided although the food shortage continued. During the later part of the Japanese occupation in 1944, when evidences of nutritional deficiencies were found even among the well-to-do classes, cases of retrobulbar neuritis were uncommon. Even during the epidemic, it was common to find only one member in a family on practically the same diet affected with retrobulbar neuritis. In our series only one instance of the disease occurring in husband and wife

was recorded. Children were exempt from this epidemic.

Statistics on the cause of retrobulbar neuritis in different countries at different times show wide variations (Benedict,¹⁰ Uthoff,¹¹ Langenbeck,¹² and Cibis¹³). One misleading factor in the etiologic consideration of retrobulbar neuritis in general is the tendency to spontaneous recovery in the majority of cases (Duke-Elder,¹⁴ Dunnington,¹⁵ Editors of E.E.N.T. Yearbooks of 1933 and 1935¹⁶). We also noted this tendency to some extent in this epidemic. Focal infection was present in a few of the cases. Syphilis could probably be ruled out by the course of the affection. Of the demyelinating diseases, multiple sclerosis, whose cause is unknown but which leads in the listed causes of retrobulbar neuritis in America and Europe, cannot be definitely excluded as a cause in some of these cases. The bilateral occurrence of the disease is, however, very much against this hypothesis. A sinus etiology usually shows a bilateral lesion with more blind spot changes than axial involvement.

Concerning the nutritional causes of retrobulbar neuritis, there is much confusion in the literature (Elliot,¹⁷ Oguchi,⁸ Moore,¹⁸ Fernando,¹⁹ Johnson,²⁰ Kilgore,²¹ Gordon and Sevringhaus,²² and Veasy²³) as to the role of vitamins B₁, B₂, B complex, and A. Experimentally produced human deficiencies of these vitamins do not cause retrobulbar neuritis as it is found in the clinics. It is generally recognized that the therapeutic effect of vitamin B₁ in neuritis is not specific (Vorhaus²⁴). The factors of the proportion of the deficiencies and of the individual reaction influence the various clinical manifestations of vitamin deficiencies in man.

Retrobulbar neuritis is a neurodystrophic process in which, according to Speransky,²⁵ the history of each individual

nervous system is important. During the Japanese occupation, not only was there shortage of food in the Philippines but there was much emotional strain or trauma on the nervous system of the people. Even in toxic amblyopia, Duke-Elder¹⁴ mentions that during periods of emotional strain, a habitual drinker or smoker may develop amblyopic symptoms.

After taking all these factors into consideration, we believe that more than one cause may have existed in this epidemic of retrobulbar neuritis (Lillie²⁶). In a population that, even before the war, showed a high incidence of nerve degeneration (although not of the optic nerve) from toxic or poor nutritional conditions, this neurodystrophic process of the optic nerve increased, under war conditions, to epidemic proportions directly and mainly because of nutritional deficiency and hypovitaminosis. Although those patients who developed this affection were certainly subjects of multiple hypovitaminosis, clinically or subclinically, and showed prominent extraocular signs of vitamin-B-complex deficiency, the eye lesion of retrobulbar neuritis was probably due to a deficiency of vitamin B₁ (beriberi factor). The few patients who, in addition to retrobulbar neuritis, had some abnormal limbal vascularization probably suffered from an ocular deficiency of vitamin-B complex. In the very few patients who, in addition to affections already named, showed an epithelial corneal dystrophic lesion without abnormal limbal vascularization, an objective ocular vitamin-A deficiency was probably also present. The predisposing factors may have been: (1) the individual and racial nervous system or "soil"; (2) the emotional strain of the war; (3) focal infection, tobacco and alcohol, lactation, other diseases, and unknown factors.

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RATE OF DARK ADAPTATION AND REGIONAL THRESHOLD GRADIENT OF THE DARK-ADAPTED EYE: PHYSIOLOGIC AND CLINICAL STUDIES*

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Measurements of the rate of dark adaptation and of the light threshold of the fully dark-adapted eye as indices of vitamin-A deficiency have been extensively studied in recent years. The earlier investigations led to the conclusion that subclinical vitamin-A deficiency, as manifested by such tests, occurs in a high percentage of the population. These reports, however, were soon followed by critical studies which questioned the norms used in diagnosing subnormal light sensitivity and emphasized the many controls necessary to obtain reliable measurements of the light thresholds.

More recent investigations have employed adequately standardized instruments and procedures in measuring light thresholds. These studies, although they do not support the view that vitamin-A deficiency is prevalent in the United States, however, do present suggestive evidence for a cause and effect relationship between vitamin-A intake and the visual threshold for light, particularly the threshold of the fully dark-adapted eye. The evidence is of two types.

1. Many patients with increased light thresholds not associated with organic disease of the eye are improved or restored to normal by vitamin-A therapy.

2. Normal subjects, when placed on a diet low in vitamin A but adequate in other essentials, may show an increase in light thresholds. Individuals vary markedly, however, in the time required to produce a significant increase in the thresholds and in the time required for re-

covery when vitamin A is resumed. These studies have been reviewed in detail by Mandelbaum,¹ Sheard,² Holmes,³ and Nylund.⁴

There is also some suggestive evidence that riboflavin may play a part in the process of dark adaptation, either directly or by influencing the ability to absorb or to utilize vitamin A. Pock-Steen⁵ reported that patients with leiodystonia and sprue complained of poor vision in dim light, and that these symptoms were not influenced by vitamin A but were greatly improved by riboflavin. A patient with Plummer-Vinson syndrome, reported by Pollak,⁶ had markedly impaired dark adaptation which was improved by riboflavin and restored to normal by brewers yeast. Kimble and Gordon⁷ found that some patients with subnormal dark adaptation who were not improved in two months on vitamin A alone were restored to normal when further vitamin A plus riboflavin was given.

Mention has been made⁸⁻¹⁵ of the occasional occurrence of visual-field defects in patients with poor dark adaptation associated with vitamin-A deficiency. The defects noted were detected on routine perimetric examination except in the studies of Weekers and Roussel. They used a special technique in which the extent of the visual field was determined at intervals during dark adaptation. They found that with dark adaptation there was a significant difference in the results for a control group of normal subjects and a group of malnourished patients from European war prison camps.

The purposes of this paper are: (a) to present norms for a new technique of

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measuring the light sensitivity, particularly of the retinal rods; (b) to offer further data on individual variations in response to an experimental diet low in vitamin A; (c) to report a series of patients with little or no systemic evidence of vitamin-A deficiency who nevertheless showed elevated light thresholds which were restored to normal either on vitamin A alone or on vitamin A plus riboflavin; (d) to present further data on the relationship between contraction of the visual field in moderate illumination and elevation of the light thresholds of the fully dark-adapted eye.

TECHNIQUE

The visual-field studies were made with a standard Ferree-Rand perimeter. The illumination incident on the perimeter arc is 7 foot-candles; the brightness of the arc, 0.7 apparent foot-candles (approximately 0.7 millilamberts). The instrument used in studying the light sensitivity has been described in previous papers.⁸⁻¹⁶ It differs from those used by other investigators in that measurements may be made in any desired retinal region from center to far periphery. The procedure used in this study is as follows.

1. The eye is exposed for 3 minutes to an adapting field whose brightness is 1,100 millilamberts.

2. The light threshold is determined at intervals during adaptation to darkness, until it shows no further significant decrease. For these measurements of the rate of dark adaptation the 1-degree white test field is placed in the nasal field 15 degrees from fixation.

3. When dark adaptation is essentially complete, usually in 35 to 40 minutes, the light threshold is measured at the fovea and at 18 other locations extending to 50 degrees in the nasal field and to 96 degrees in the temporal field.

4. At the completion of these measurements a photograph of the pupil is taken with photoflash illumination. This is used in correcting the thresholds for differences in size of pupil as explained below.

Individual differences in size of pupil influence not only the effective brightness of the test spot but also that of the adapting field. In measurements of the dark-adaptation curve, rigid standardization of this variable factor can be achieved only by the use of an artificial pupil for viewing both the adapting field and the test field. In this study, because of the practical difficulties in using such a device, no attempt has been made to eliminate this variable in determinations of the adaptation curve. It is, however, feasible to correct the final thresholds of the fully dark-adapted eye for differences in size of pupil.¹⁷ The final threshold, therefore, can provide a more reliable basis for detecting slightly subnormal light sensitivity than the thresholds measured during the course of dark adaptation, particularly in the case of patients whose pupils are fixed either by a drug or by organic changes. In this study the data used in charting the threshold gradient of the dark-adapted eye are corrected to give the equivalent threshold for a pupil 7 mm. in diameter.

VARIATION IN NORMAL SUBJECTS*

In order to make a diagnosis of subnormal (increased) light thresholds, it is necessary to have data, obtained under standard conditions, showing the range of normal physiologic variation. These data should apply to subjects of the ages, levels of intelligence, and so forth likely to occur in the clinical studies. Our normal group comprised 101 subjects whose ages ranged from 14 to 70 years. Fourteen of

*I am indebted to Dorothy C. Leonhardt for testing the normal subjects and making the statistical computations.

the subjects were Negroes. All had clear media; normal pupillary reactions, normal fundi, and corrected visual acuity of 20/20 or better.

The data on rate of dark adaptation are summarized in Table 1. Column 2 gives in logarithmic units the mean value of the threshold after 1, 2, 4, 6, and so forth minutes of dark adaptation. For each subject these thresholds were read from the smooth curve drawn through the experimentally determined points. Column 3 gives for each of the selected times of dark adaptation the standard deviation* of the threshold, S.D. The greatest variation (S.D. equals 0.38) occurs at 12 minutes; the least (S.D. equals 0.24), at 30 and 35 minutes. The distri-

S.D. and $M - 2$ S.D.; and 99.7 percent between $M + 3$ S.D. and $M - 3$ S.D. A threshold between $M + 2$ S.D. and $M + 3$ S.D. may be considered as questionably subnormal, since only about 2.5 percent of normal individuals have thresholds within these limits. A threshold greater than $M + 3$ S.D. for practical purposes

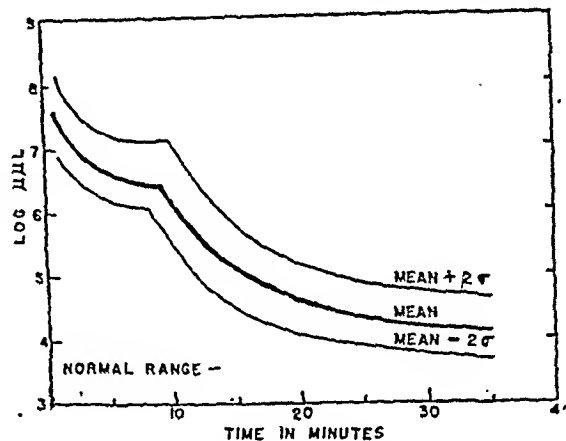


Fig. 1 (Sloan). Rate of dark adaptation after pre-adaptation to 1,100 millilamberts. A 1-degree white test field located 15 degrees from fixation in nasal field. The area between the upper and lower curves includes 95 percent of those tested.

may be accepted as definite evidence of subnormal light sensitivity.

Figure 1 shows the adaptation curve based on the mean values of threshold, as well as the curves for $M + 2$ S.D. and $M - 2$ S.D. The area between the two latter curves defines the region in which 95 percent of the thresholds of normal individuals may be expected to fall. Thresholds close to the upper curve may be considered questionably subnormal and those more than about 0.3 log unit above it definitely so. A distinct break in the course of the adaptation curve occurs after about 8 or 10 minutes of dark adaptation. The time at which it occurs is known as the "transition time." The thresholds prior to the break measure cone response, because during the early stages of dark adaptation the cone thresh-

TABLE 1

DATA ON RATE OF DARK ADAPTATION

Minutes in Dark	Log Threshold, Micromicrolamberts	
	Mean	Standard Deviation
1	7.53	0.31
2	7.10	0.28
4	6.75	0.25
6	6.62	0.26
12	5.69	0.38
15	5.12	0.33
20	4.60	0.28
25	4.37	0.25
30	4.22	0.24
35	4.16	0.24

Average S.D. 0.28

Mean of Transition Time (minutes)—8.9.
Standard Deviation—1.36.

bution of the individual thresholds at each time of dark adaptation was found to show a close agreement with the theoretical "normal distribution curve." In a normal distribution, 68 percent of the cases fall within $M +$ S.D. and $M -$ S.D.; 95 percent are included between $M + 2$

* The standard deviation, S.D., is a statistical measure of the scatter of the individual observations above and below the mean, M .

hold is lower than that of the rods; those after the break measure rod response because the rod threshold has fallen below that of the cones. The last entry in Table

TABLE 2
DATA ON THRESHOLDS OF FULLY DARK-
ADAPTED EYE

Location in Horizontal Meridian	Log Threshold, Micromicrolamberts	
	Mean	Standard Deviation
50° Nasal	4.50	0.53
40°	4.26	0.35
30°	4.16	0.30
20°	4.07	0.28
15°	4.01	0.25
10°	4.09	0.24
6°	4.26	0.27
0°	4.87	0.49
6° Temporal	4.22	0.30
10°	4.11	0.28
20° (or 22°)	4.21	0.23
30°	4.14	0.24
40°	4.10	0.22
50°	4.16	0.26
60°	4.24	0.28
70°	4.38	0.33
80°	4.74	0.50
90°	5.33	0.72
96°	5.98	0.95

Horizontal-meridian threshold (average of thresholds at 19 different locations)—4.41.
Standard Deviation—0.25.

1 gives the mean value and the standard deviation of the transition time.

Table 2 and Figure 2 give similar data on the thresholds of the fully dark-adapted eye at 19 different locations in the horizontal meridian. As explained previously, a correction factor has been applied to these values to give the thresholds for a pupil of 7 mm. in diameter. Column 2 of the table gives the mean values of the threshold; column 3, the corresponding standard deviations. The standard deviations indicate that there is greater variability in threshold in the far periphery and at the fovea than in the paracentral regions. The relatively large range of variation at the fovea is probably due in part to the difficulty in maintaining accurate fixation. The pericentral fixation

device, used in measuring the foveal threshold, does not in some patients maintain fixation as accurately as does the luminous red fixation target used for the other measurements.

The last entry in Table 2 gives the mean and standard deviation of the "horizontal-meridian threshold." This is an index of the average threshold level throughout the horizontal meridian and is computed for each subject by averaging the readings at the 19 different locations. The horizontal-meridian threshold gives an evaluation of the general threshold level and should be a sensitive index of any condition producing a generalized rather than a localized decrease in light sensitivity. Figure 2 shows graphically the threshold gradient, or variation in threshold from center to periphery, for the horizontal meridian. Only the values two standard deviations above and below the mean are charted. The mean threshold

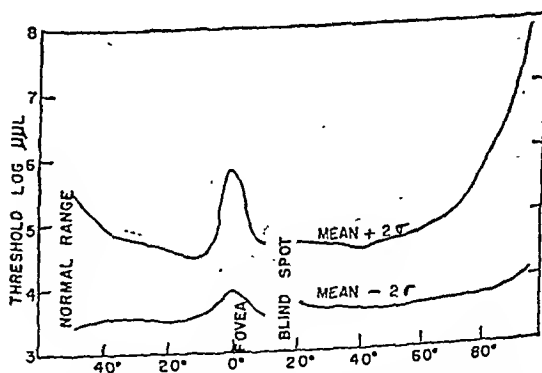


Fig. 2 (Sloan). Threshold gradient of dark-adapted eye in horizontal meridian. A 1-degree white test field. The area between the upper and lower curves includes 95 percent of those tested.

lies midway between the two curves shown in the figure. As in Figure 1 these two curves define the region in which 95 percent of the thresholds of normal individuals may be expected to fall.

In previous investigations of the dark-adaptation curves of normal subjects, an increase in threshold with age has been found,^{18, 19} indicating a possible need

for different norms for different age groups. An analysis of our data shows that the increase with age is attributable in part, although not entirely, to the accompanying decrease in area of pupil. When the original threshold measurements are used, without correction for differences in size of pupil, there is a correlation of 0.48 between the horizontal-meridian threshold and the age of the subject. When, however, this correction is applied, thus eliminating the effect of pupil size, a relatively low correlation (0.28) is found between age and light threshold. Further statistical analysis shows that, without correction for size of pupil, the light threshold increases 0.10 log unit per decade. When this correction is made, the increase per decade is only 0.05 log unit. It may be concluded, therefore, that the increase in threshold with age is negligible* when the threshold is corrected for differences in size of pupil.

EFFECT OF A DIET LOW IN VITAMIN A

The effect of a diet low in vitamin A but adequate in all other essentials was studied in five subjects.[†] Cases 1 to 3 received less than 200 I.U. of vitamin A per day, Cases 4 and 5 less than 100 I.U.

Cases 1, to 3. The changes in the horizontal-meridian threshold while on the diet are shown in Figure 3. In Case 1, this threshold increased only from 4.01 to 4.19 log units during the 30 days on the diet. This subject was not available for further tests after a normal diet was resumed. In Case 2, the diet was maintained for a period of 217 days. The high-

est threshold, 4.49 log units, was found in one of the three tests made before the diet was started; the lowest, 4.21 log units, after 195 days on the diet. It may be seen from the graph that there are irregular changes of small magnitude not related in any way to the dietary status. The average threshold based on all 12 tests is 4.35 log units with a mean variation of only ± 0.08 . In these two subjects the rate

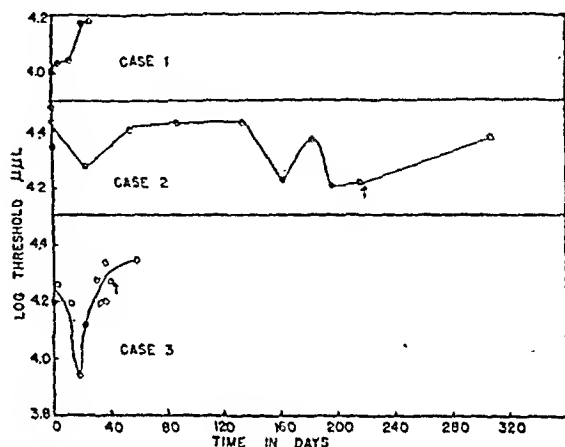


Fig. 3 (Sloan). Changes in threshold of three subjects on a diet deficient in vitamin A. The thresholds are the average of measurements at 19 locations in the horizontal meridian. Arrows indicate cessation of diet.

of dark adaptation likewise showed no significant change. In Case 3, while the changes in threshold are also of small magnitude there is some evidence that they are associated with the reduced intake of vitamin A. The drop in threshold during the first 18 days from 4.20 to 3.95 is probably a practice effect. From the 18th day onward there was a slight steady rise. On the 38th and 41st days the thresholds were 4.34 and 4.28 respectively. The changes in the adaptation curve paralleled those in the threshold gradient. After 19 days on a normal diet plus haliver oil, both curves were still about 0.4 log unit above the lowest previous level. Eighteen days later the adaptation curve had returned to its previous level. The threshold gradient was not determined on this date.

* This has been proved only in the case of thresholds for white light. When blue light is used, as in the Hecht adaptometer, the increased absorption of the shorter wave lengths of light by the lens in older subjects may be a factor.

[†] I am indebted to Dr. Lela E. Booher for the opportunity to examine Cases 4 and 5. They are reported as Case 1, and Case 3 in an article by Booher, Callison, and Hewston.²⁰

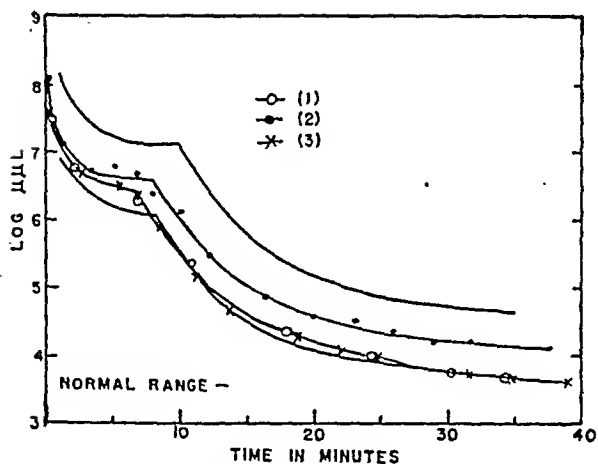


Fig. 4 (Sloan). Adaptation curves of Case 3. (1) After 18 days on diet deficient in vitamin A. (2) After 41 days on diet. (3) After 37 days on normal diet supplemented by haliver oil.

In Figure 4, the adaptation curves for three dates are charted to show the in-

crease in threshold and subsequent recovery. It should be emphasized that the highest thresholds of this subject were well within normal limits. Consequently, even if the slight changes are considered to be related to the vitamin-A intake, it is questionable whether they can be interpreted as evidence of an actual deficiency in the clinical sense. None of the three subjects while on the diet deficient in vitamin A showed any significant change in the visual fields for a $\frac{1}{2}$ -degree white test object. In Case 2, tests were also made with 1-degree blue and red test objects and likewise showed no change.

Case 4, reported also in a previous paper,⁸ after 42 days on the diet, showed marked elevation of the threshold gradi-

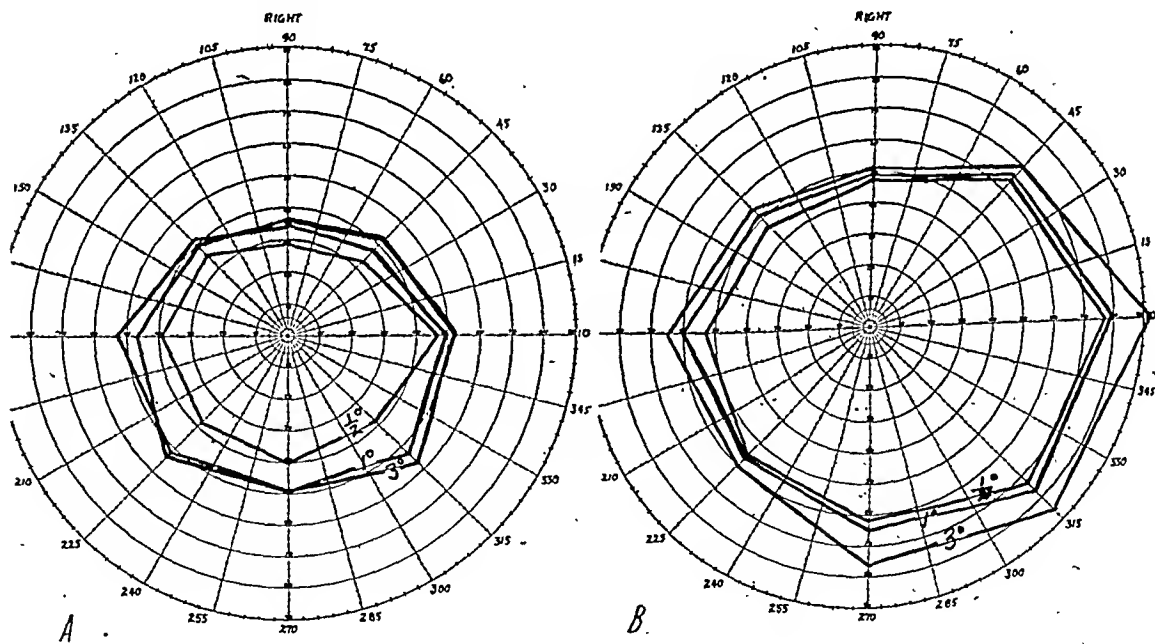
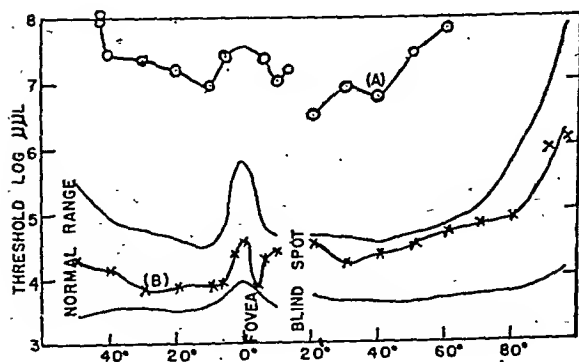


Fig. 5 (Sloan). Case 4. Threshold gradient and visual field of right eye for 3-degrees, 1-degree, and $\frac{1}{2}$ -degree white test objects. (A) After 42 days on a diet deficient in vitamin A. (B) After taking cod-liver oil for 12 days. Note that (A) and (B) on the threshold-gradient graph refer to these same two dates.



ent (about 3 log units) and peripheral field defects in both eyes demonstrable with $\frac{1}{2}$ -degree, 1-degree, and 3-degree white test objects. The limits of the field for blue, tested only for the right eye, were normal, but within these limits there were small areas in which the blue test object disappeared completely. The location of these areas in the different meridians suggested that they were parts of a ring scotoma. The visual fields and the light threshold were normal when redetermined after the subject had been taking cod-liver oil for 12 days. Figure 5 shows the threshold gradient and the fields of the right eye for $\frac{1}{2}$ -degree, 1-degree, and 3-degree white test objects before and after vitamin A was restored to his diet.

Case 5, whose light threshold (horizontal-meridian average) had increased only 0.5 log unit after 91 days on the diet, had at this time defects in the peripheral fields similar to those of Case 4 but less marked. The visual fields of the right eye for a 1-degree white test object, prior to, during, and after the diet are shown in Figure 6. There was no significant change in the field for 1-degree blue:

OBSERVATIONS IN CLINICAL CASES

Of nine patients examined, eight were referred because of visual symptoms suggesting poor night vision, one because of a skin condition suggesting a possible vitamin-A deficiency. With the exception of Case 11, these patients gave no history of any obvious inadequacy in diet. Four of the patients were examined at the Wilmer Institute; five, at the A.A.F. School of Aviation Medicine.* In two cases, the threshold gradient was within the normal range; in one case, close to the borderline normal curve; and in six cases,

definitely above this curve in some or all regions. All nine patients showed significant improvement either on vitamin-A therapy alone or on vitamin A plus riboflavin.

Case 6. This patient was first aware of poor night vision while driving a car in the country at night some weeks after the

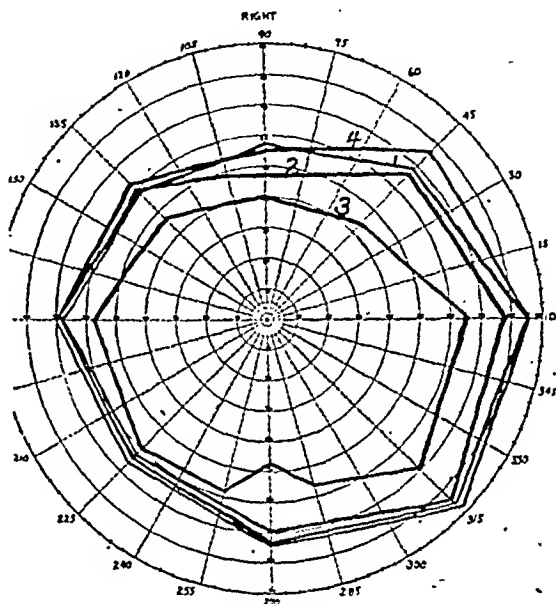


Fig. 6 (Sloan). *Case 5*, Visual field of right eye for 1-degree white test object. (1) Prior to diet deficient in vitamin A. (2) After 28 days on diet. (3) After 91 days on diet. (4) After administration of cod-liver oil for 35 days.

birth of her first child. Examination showed that the threshold gradient and the adaptation curve were about 3 log units above the average normal curves (fig. 7) After three months on massive doses by mouth of vitamin A (90,000 I.U. per day), there was definite improvement. It will be noted in Figure 7 that the decrease in threshold was not of the same magnitude in different retinal regions. At 35 degrees in the temporal field, there was no change in the threshold, but at 10 degrees in the nasal field, there was a decrease of 1.5 log units. Since vitamin-A therapy had not resulted in complete recovery, the effect of 10 mg. per day of riboflavin was then tested.

* Cases 10 and 11 have been reported in a previous paper by W. M. Rowland and the author.²¹

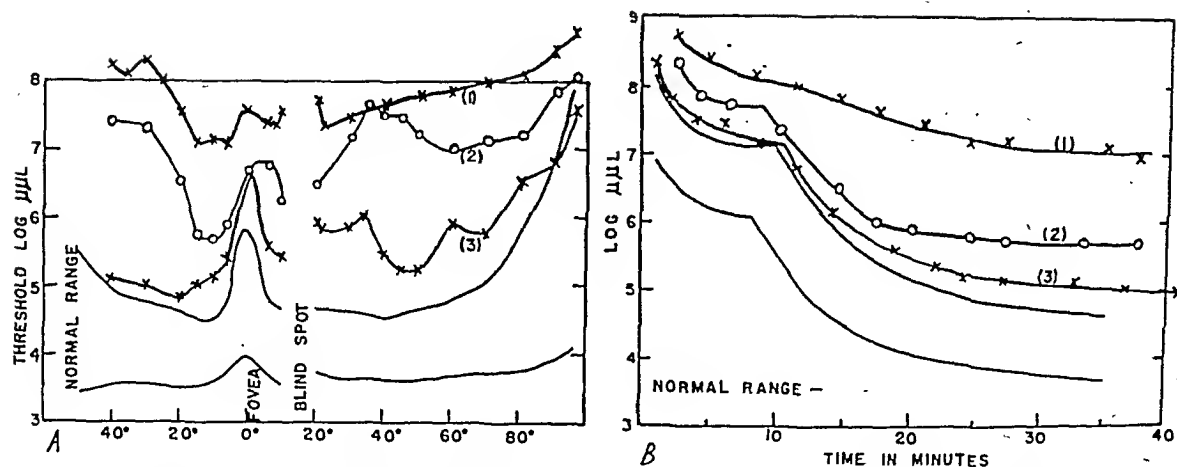


Fig. 7 (Sloan). Case 6. Progressive changes in threshold-gradient (A) and adaptation curves (B) of right eye. (1) October 18, 1940, prior to therapy. (2) January 7, 1941, after taking vitamin A for 3 months. (3) January 15, 1941, after taking riboflavin for one week. The daily dose was 90,000 I.U. of vitamin A; 10 mg. of riboflavin.

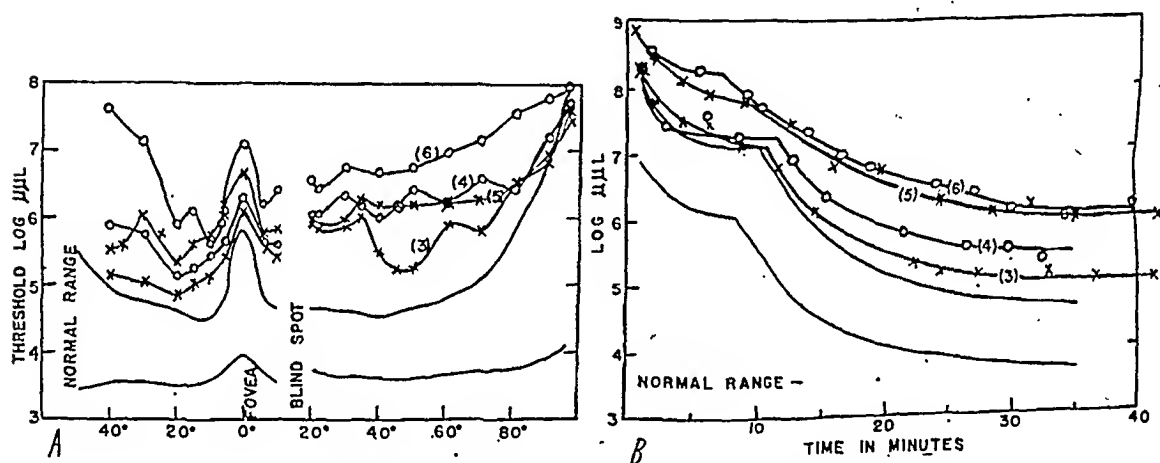


Fig. 8 (Sloan). Case 6. Progressive changes in threshold-gradient (A) and adaptation curves (B) of right eye after further therapy with riboflavin. (3) January 15, 1941. (4) January 17th. (5) January 20th. (6) February 26th. Vitamin A was discontinued on January 7th. Riboflavin therapy was started on January 7th; the entire B complex was started on January 20th.

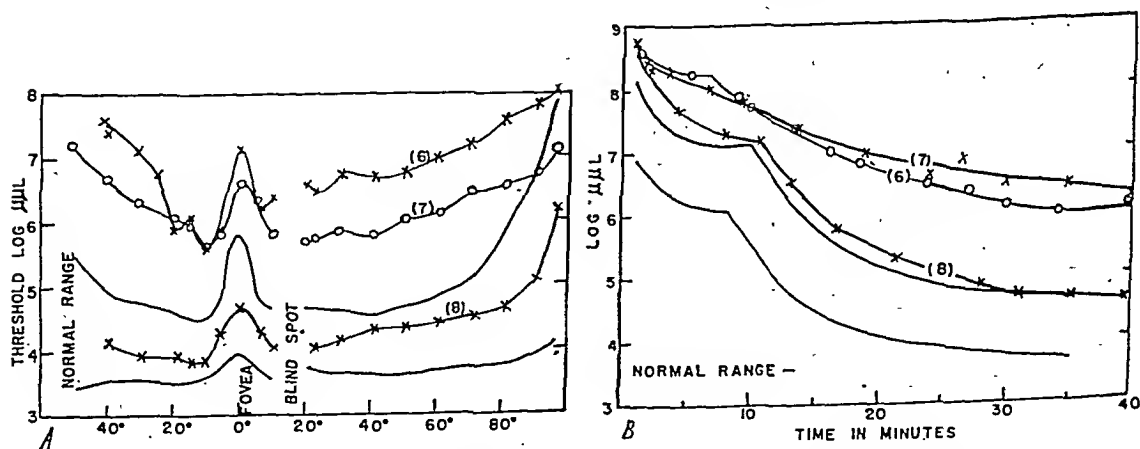


Fig. 9 (Sloan). Case 6. Progressive changes in threshold (A) and adaptation (B) curves of right eye during therapy with vitamin A and entire B complex from February 26 to June 1, 1941. (6) February 26th. (7) March 1st. (8) July 14th.

The first week after riboflavin was substituted for vitamin A, there were further improvements, marked in some retinal regions, slight in others. Riboflavin therapy without vitamin A for an additional six weeks (January 15th to February 28th), however, was accompanied by a gradual rise in the thresholds (fig. 8). The effect of treatment with vitamin A plus the entire B complex is shown in Figure 9. It may be noted that, although the adaptation curve measured at 15 degrees in the nasal field showed no significant change after three days, the threshold gradient revealed that there was significant improvement in other retinal regions.

The patient continued taking vitamin A and the B complex from February 26th until June 1st, when she stopped because subjectively her night vision seemed perfectly normal. She returned for retests on July 14th. On this date the adaptation curve was slightly above the borderline normal curve. The threshold, however, continued to decrease after 40 minutes of dark adaptation, reaching its lowest level which was well within normal limits only after 75 minutes of dark adaptation. The threshold gradient, determined after dark adaptation was complete, was close to the average normal curve. On this date, therefore, the only evidence of defective sensitivity to light was a slow rate of dark adaptation with no abnormality in the thresholds of the completely dark-adapted eye.

Figure 10 summarizes the changes in the horizontal-meridian threshold in relation to therapy throughout the entire period that this patient was studied. The visual field of the right eye was tested with $\frac{1}{2}$ -degree white and 1-degree blue test objects on January 15th, February 26th, and July 14th (fig. 11). On January 15th, only the field for blue was contracted but on February 26th the field for

$\frac{1}{2}$ -degree white also showed concentric contraction similar to that noted in Case 4. The defect in the peripheral field found on February 26th but not on January 15th is consistent with the much higher peripheral light thresholds found on the second

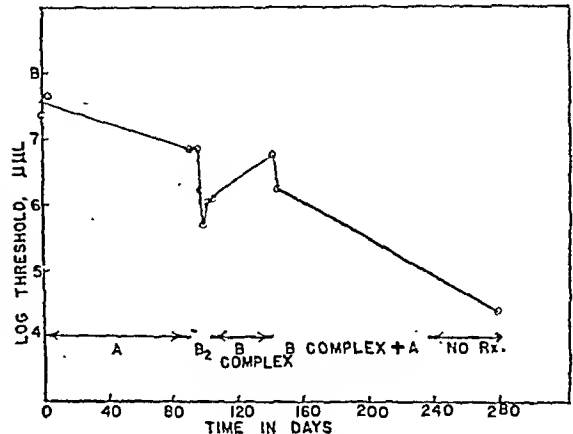


Fig. 10 (Sloan). Case 6. Changes in horizontal meridian threshold of right eye.

date. The concentration of vitamin A in the blood plasma, determined only on January 17th and February 26th, was well within normal limits on both dates (202 and 218 I.U. per 100 cc.). If the markedly elevated light thresholds noted on February 26th are considered to be definite evidence of an ocular vitamin-A deficiency, then it must be assumed that such deficiency can exist in association with adequate amounts of vitamin A in the blood plasma.

Case 7. This man, a member of the staff of the medical school, requested a dark-adaptation test because he was having some difficulty in seeing faint images on a fluorescent screen. Although both the adaptation curve and the threshold gradient were within normal limits, it seemed worth while to determine the effect of vitamin therapy. The changes in the horizontal-meridian threshold are shown in Figure 12. There was a temporary improvement with vitamin A alone and a sustained improvement with the ad-

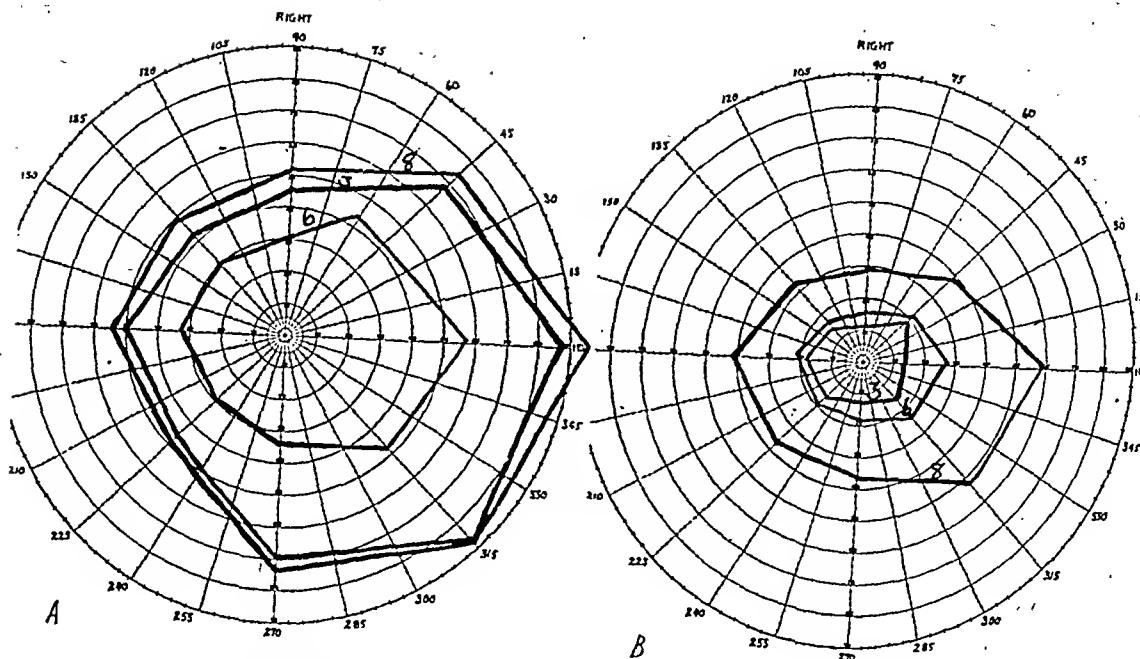


Fig. 11 (Sloan). Case 6. Visual fields of right eye. (A) For $\frac{1}{2}$ -degree white. (B) For 1-degree blue. (3) January 15, 1941. (6) February 26th. (8) July 14th.

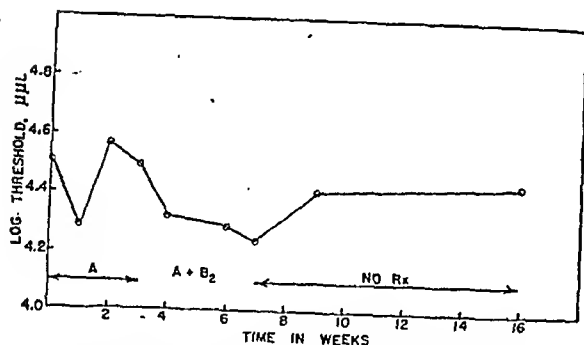


Fig. 12 (Sloan). Case 7. Changes in horizontal meridian threshold with vitamin therapy. The daily dose was 50,000 I. U. of vitamin A, 10 mg. of riboflavin.

dition of riboflavin, similar to that observed in Case 6. The visual fields were not tested. The maximum decrease in threshold was only about 0.3 log unit and the relationship to therapy is therefore somewhat doubtful in this case.

Case 8. This patient was referred by her doctor for light-sense tests because dryness and itchiness of the skin suggested a possible vitamin-A deficiency. The adaptation curve and the threshold gradient (fig. 13) were close to the bor-

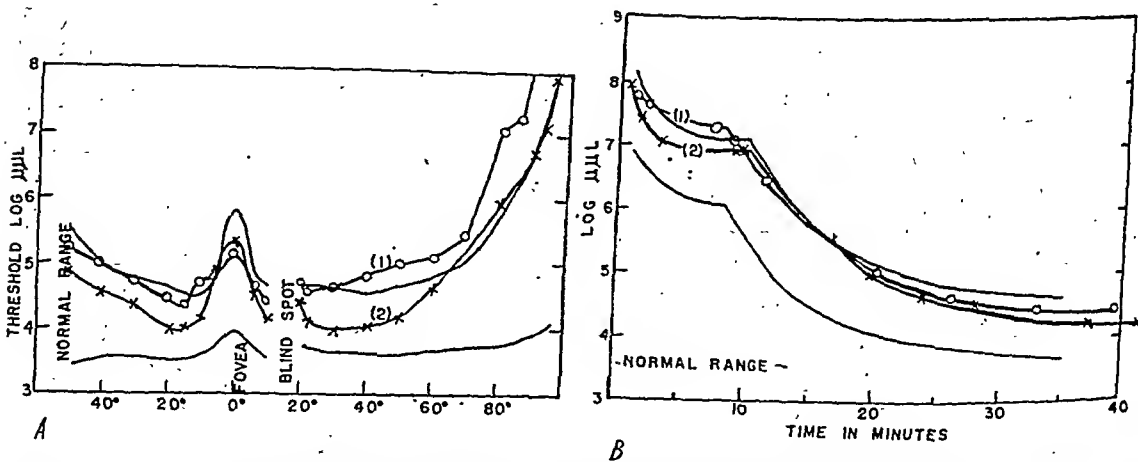


Fig. 13 (Sloan). Case 8. Threshold-gradient (A) and adaptation (B) curves. (1) Before treatment. (2) After one month on vitamin A, 200,000 I.U. per day.

derline of normal. The visual field for 1-degree white was normal. Other test objects were not used. After one month of vitamin-A therapy (200,000 I.U. per day) there was definite improvement in the threshold gradient, particularly in the far temporal field where the decrease was more than one log unit. The only significant change in the adaptation curve was a slight decrease in the final thresholds.

Case 9. This patient reported that for several years she had been unable to see as well as others in dim illuminations. The threshold gradient of the left eye was definitely elevated (fig. 14). At 30 degrees in the nasal field, for example, the threshold was 1.6 log units above the average normal value. After she had taken vitamin A for 17 days, a recheck of the thresholds in the nasal field gave essentially the same results at 6 degrees, 10 degrees, and 15 degrees, but at 20 degrees, 30 degrees, and 40 degrees showed a decrease of 0.7, 1.3, and 1.2 log units respectively. The visual fields of both eyes, tested on this date revealed marked

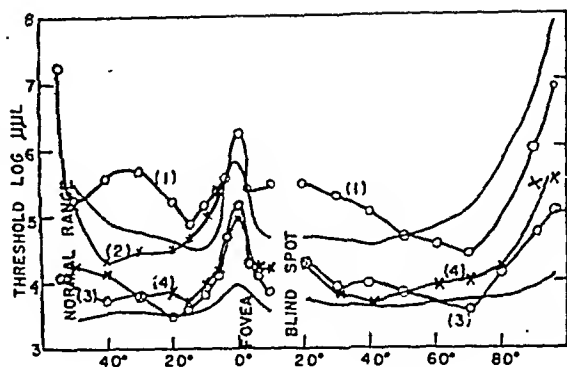


Fig. 14 (Sloan). *Case 9.* Threshold gradient of left eye. (1) Before treatment. (2) After 27 days on vitamin A. (3) After 9 weeks on vitamin A. (4) After 4 months without treatment. The amount of vitamin A per day was not recorded.

concentric contraction for white test objects and moderate contraction for a 1-degree blue test object. The fields of the left eye are shown in Figure 15. After 9 weeks of vitamin-A therapy, the threshold gradient and the visual fields were within normal limits. Four months without vitamin A did not result in any significant increase in the thresholds.

Case 10. Prior to vitamin therapy, the

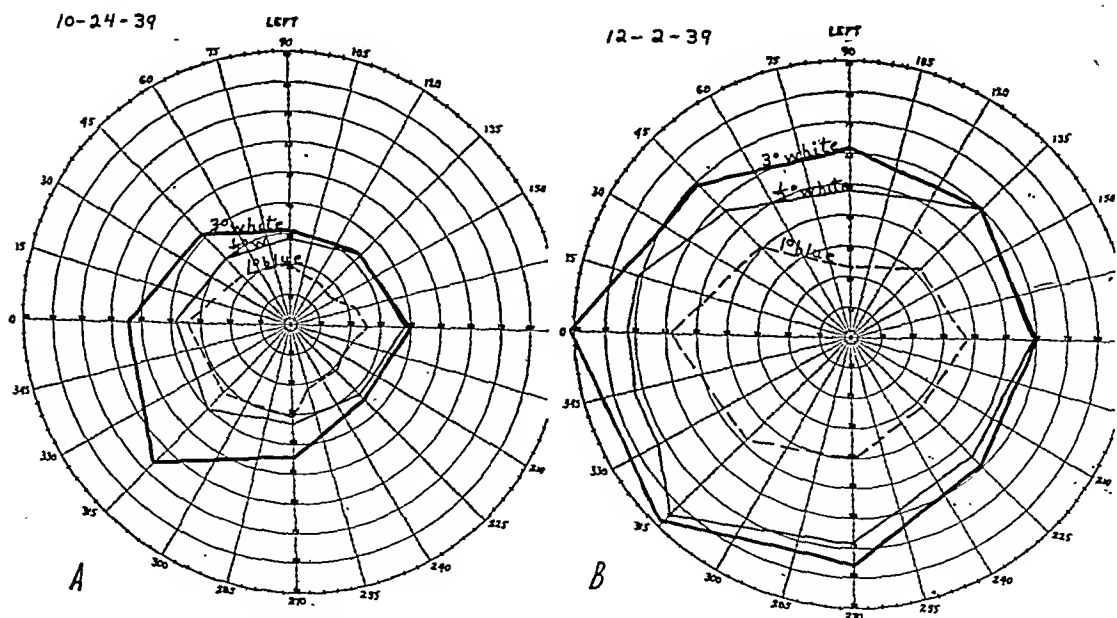


Fig. 15 (Sloan). *Case 9.* Visual fields of the left eye for 3-degrees white, $\frac{1}{2}$ -degree white, and 1-degree blue. (A) October 24, 1939, after 17 days on vitamin A. (B) December 2, 1939, after 9 weeks on vitamin A.

thresholds were elevated throughout the entire horizontal meridian. The adaptation curve showed a normal rate of dark adaptation with elevation only of the final

units before treatment; 4.5 and 4.2 after three and four months of vitamin therapy.

Case 11. This patient, while subsisting entirely on emergency rations, had lost

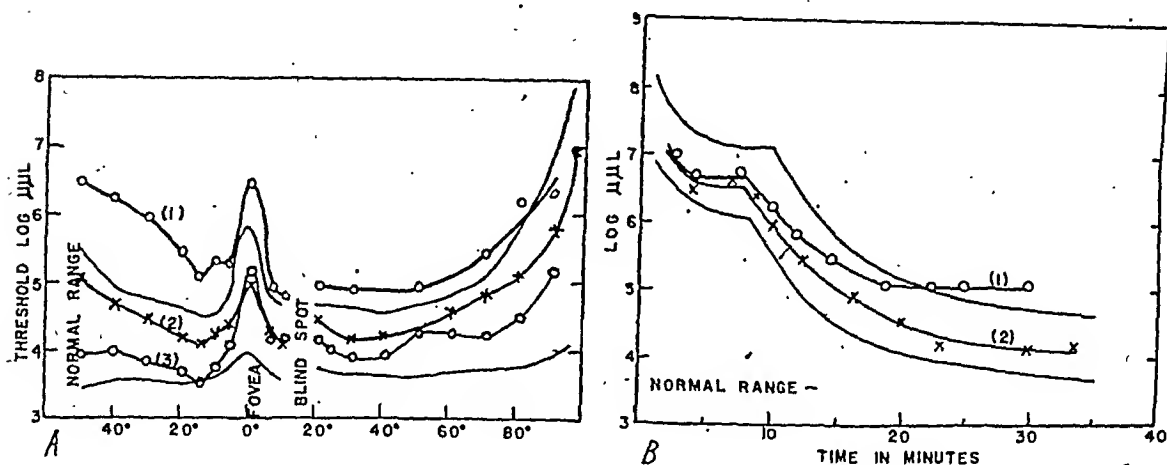


Fig. 16 (Sloan). *Case 10.* Threshold-gradient (A) and adaptation (B) curves. (1) Before vitamin therapy. (2) After daily doses of 100,000 I.U. of A, 5 mg. of B₂ for 3 months. (3) After 4 months on this regime.

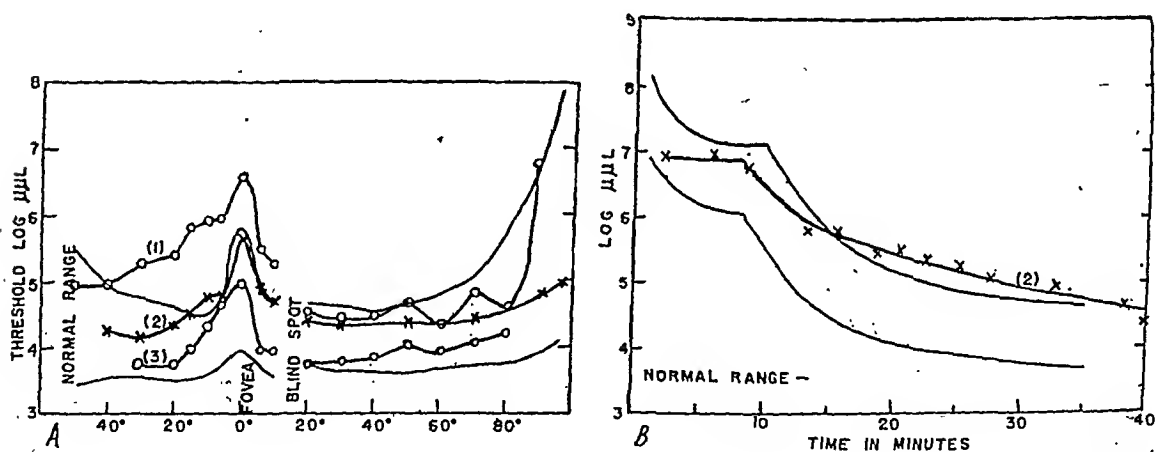


Fig. 17 (Sloan). *Case 11.* Threshold-gradient (A) and adaptation (B) curves. (1) After taking vitamins A and D, amounts unknown. (2) After 3 weeks on 100,000 I.U. of vitamin A, 8,000 units of vitamin D per day. (3) After 5 weeks during which the B complex including 3 mg. of riboflavin per day was taken in addition to vitamins A and D.

threshold about one log unit above average normal (fig. 16). After daily doses of 100,000 I.U. of vitamin A and 5 mg. of riboflavin for three months the threshold gradient and the adaptation curve were within normal limits. There was further improvement after an additional month of the same treatment. The average horizontal-meridian threshold was 5.5 log

weight and appetite and developed marked symptoms of night blindness. For some weeks prior to our first examination of the patient, he had been on a normal diet supplemented by vitamins A and D in undetermined amounts. His threshold gradient was elevated almost 2 log units above average normal in the para-central nasal field. (fig. 17). After he

had taken 100,000 I.U. of vitamin A and 8,000 units of vitamin D for three weeks, there was definite improvement. The adaptation curve at this time showed an abnormally slow rate but a final threshold close to the borderline normal value. The threshold gradient showed a further decrease five weeks later after treatment with vitamins A, D, and the B complex, including 3 mg. of riboflavin per day.

Case 12. This patient had also taken vitamins A and D prior to the first examination. The thresholds (fig. 18) were elevated in some regions, normal in others. After three months on a regime of 25,000 I.U. of vitamin A and 5 mg. of riboflavin per day, there was definite improvement and the entire curve was with-

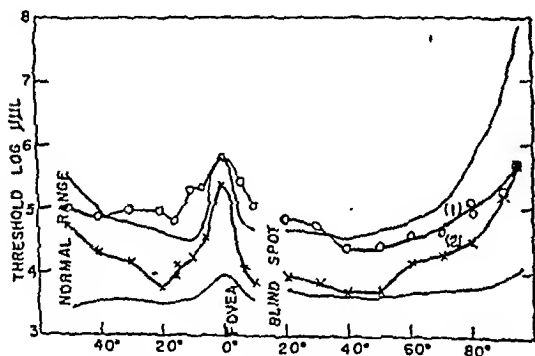


Fig. 18 (Sloan). *Case 12.* Threshold gradient curves. (1) After taking vitamins A and D, amounts unknown. (2) After daily doses of 25,000 I.U. of vitamin A, 5 mg. of B₂ for 3 months.

in the normal range. The maximum decrease occurred at 6 degrees in the temporal field where the threshold fell from 5.40 to 4.05 log units.

Case 13. This patient had taken vitamin A prior to the first examination. The threshold gradients of both eyes were determined (fig. 19). That of the right eye was close to the borderline normal curve while that of the left eye revealed much more marked defects in some regions. At 60 degrees in the temporal field, for example, the threshold was 2.4 log

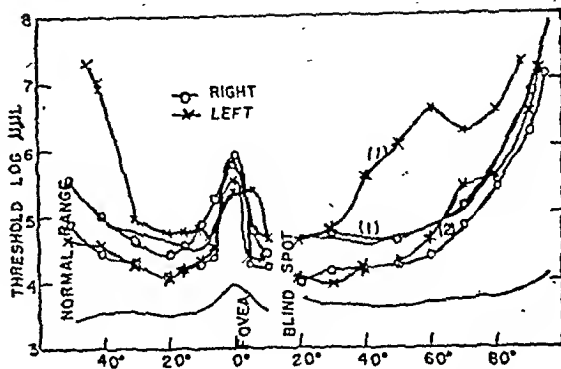


Fig. 19 (Sloan). *Case 13.* Threshold gradients of right and left eyes. (1) After taking vitamin A, amounts unknown. (2) After daily doses of 50,000 I.U. of vitamin A, 5 mg. of B₂ for 3 months.

units above the average normal value. After three months on daily doses of 50,000 I.U. of vitamin A and 5 mg. of riboflavin the threshold gradients of both eyes were essentially the same and were within the normal range.

Case 14. This patient had a threshold gradient (right eye) within normal limits (fig. 20). The left eye was not tested. He had not taken any vitamin supplements prior to the first examination. After 7 and 13 weeks, during which time he took 100,000 I.U. of vitamin A and 5 mg. of riboflavin per day, retests showed a threshold gradient close to the lower normal level, indicating better than average normal sensitivity. The average

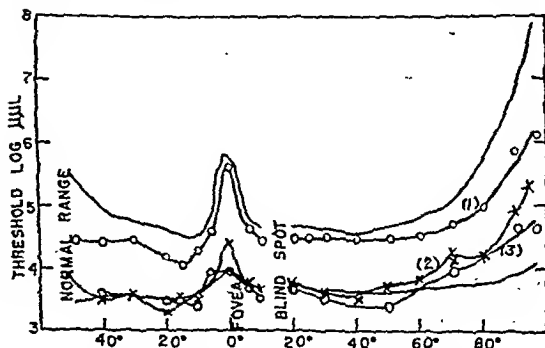


Fig. 20 (Sloan). *Case 14.* Threshold gradients. (1) Prior to vitamin therapy. (2) After daily doses of 100,000 I.U. of vitamin A and 5 mg. of B₂ for 7 weeks. (3) After 13 weeks on this regime.

decrease in threshold following therapy was 0.8 log unit.

COMMENTS

In two patients in this study (cases 6 and 11) increased rod thresholds during the earlier stages of dark adaptation were observed on one occasion when the final threshold of this same retinal region was within normal limits. In general, however, our findings are in agreement with the accepted view that in vitamin-A deficiency the light threshold of the fully dark-adapted eye is increased earlier and to a greater extent than the thresholds measured during the course of dark adaptation. Our results also show that the final threshold of the dark-adapted eye may be normal in some retinal areas, elevated in others. The improvement which follows vitamin-A therapy may likewise occur earlier or may be more marked in some areas than in others. Tests of the light sensitivity of only a single retinal region may therefore fail to reveal defects or to detect improvement in retinal function following therapy.

Because of the relatively wide range of normal variation in threshold, it is possible for an individual whose optimal threshold gradient is close to the lower limit of normal to have an increase in thresholds of as much as one log unit above his own normal level and still be within the normal range. Two such cases were observed in this study (cases 7 and 14) and were diagnosed as deficient in vitamin A from the fact that significant improvement in thresholds followed vitamin therapy. It has been my experience that subjects with normal thresholds do not as a rule show any significant decrease in thresholds when large amounts of vitamin A are administered. When such improvement does occur, therefore, it is reasonable to suppose that the previous level, although within the normal range,

was not normal for the individual in question.

Of our nine subjects with visual defects responding to vitamin therapy, only one gave a definite history of a previously inadequate diet. In the one case in which determinations were made of the vitamin-A content of the blood, normal values were found in association with fairly marked elevation of the light thresholds. If we accept as evidence of an ocular vitamin-A deficiency elevated rod thresholds which return to normal following therapy, then we must admit that individuals ingesting a diet containing adequate amounts of vitamin A, who have a normal concentration of vitamin A in the blood and no evidence of deficiency elsewhere in the body, can nevertheless have an insufficient supply of vitamin A in the retina or a deficient ability to utilize it.

Conversely it is possible, at least for some individuals, to subsist for many months on a diet containing very little vitamin A, but adequate in other respects, without showing ocular or other evidence of a deficiency. While it is probable that in such subjects the liver reserves are drawn upon to replace what is lacking in the diet, it is not clear why these reserves do not prevent the development of visual defects in other subjects. The possible role played by riboflavin needs further study to determine whether it has a direct effect on retinal function or merely has some influence on the ability of the retina to utilize vitamin A. In 7 of the 9 cases reported in this study, riboflavin and vitamin A were given and in at least one case there is definite evidence that simultaneous use of both vitamins was necessary to restore the thresholds to normal.

Concentric contraction of the peripheral isopters of the visual field without other evidence of pathologic conditions of the eye is often attributed to poor cooperation of the patient, hysteria, and so

forth. The findings of this study suggest that in such cases the possibility of a vitamin-A deficiency should also be considered.

Visual-field studies alone, however, cannot be considered adequate to detect all cases of vitamin-A deficiency. Defects demonstrable by the usual perimetric tests are sometimes, but not always, present when the thresholds of the dark-adapted rods are increased. A close parallel is not to be expected between these thresholds and the extent of the visual field, since the latter is normally determined when the eye is adapted, not to complete darkness, but to a low level of brightness. In the Ferree-Rand perimeter, for example, the brightness of the perimeter arc is approximately 0.7 millilambert. Studies now under way in this laboratory indicate that at this level of light adaptation the rod and cone thresholds of the normal eye in a given retinal region are approximately equal. A significant contraction of the visual field would, therefore, be expected when both cone and rod thresholds were elevated but might not occur when only the rods or only the cones were affected.* Previous studies of the adaptation curve in experimental vitamin-A deficiency^{18, 23} have shown that a slight

increase in the final cone threshold usually accompanies a marked elevation of the rod section of the curve. When visual-field defects are observed in patients with vitamin-A deficiency it is probable, therefore, that the cone as well as the rod thresholds of the far periphery are significantly increased.

SUMMARY AND CONCLUSIONS

1. Data are given showing the range of variation among normal subjects in (a) the dark-adaptation curve of a single retinal region and (b) the threshold gradient of the fully dark-adapted eye in the horizontal meridian of the retina.

2. The same tests were given to five subjects on diets low in vitamin A. Two showed no significant change in the adaptation curve or the threshold gradient after 30 and 195 days respectively on the diet; two showed only slight increase in the thresholds after 41 and 91 days; and one showed a very marked rise in the thresholds after 42 days. Two of the five developed concentric contraction of the visual fields which returned to normal after vitamin A was restored to the diet.

3. Studies were also made of nine patients with elevated light thresholds which were restored to normal following vitamin therapy. The findings indicate that riboflavin in addition to vitamin A may sometimes be required to bring about complete recovery.

4. The results of these studies suggest that concentric contraction of the visual field occurs frequently in patients with ocular vitamin-A deficiency and probably indicates cone as well as rod involvement.

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* Confirmation of this is found in the fact that in two cases of typical achromatopsia (a condition in which there is, presumably, complete loss of cone function with normal rod function), I found entirely normal fields for a 1-degree white test object. A case of incomplete achromatopsia, reported previously²² has, in addition, an abnormally slow rate of dark adaptation and an elevated threshold gradient similar to those of patients with vitamin-A deficiency. This subject, who apparently has dysfunction of both cones and rods has also a concentrically contracted field for a 1-degree white test object.

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THE INFLUENCE OF GENERAL METABOLIC AND NUTRITIONAL DISTURBANCES UPON THE RESISTANCE OF THE CORNEA

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The corneal stroma is one of the strongest and most resistant tissues of the human body. Anyone who has made a corneal puncture with a very sharp needle knows how much effort is required to push the needle through the stroma, how the cornea is indented during this procedure, and how the needle becomes anchored within the tissue, which resists advancement of the needle through the cornea.

The cornea is also relatively resistant to infections. Severe purulent conjunctivitis does not always damage the cornea, and there is rarely a bacterial invasion of the stroma in corneal erosion, not even in the recurring type, in which very extensive epithelial defects occur. The most dangerous abrasions and traumas due to small foreign bodies are, perhaps, those which dentists encounter during the removal of calcareous deposits. The smallest lesions of this kind often lead to the most destructive corneal infections.

The relatively great resistance of the corneal stroma to infections is particularly surprising in view of the absence of blood vessels, which in other tissues represent the main defense mechanism. The basis for this unexpected resistance to infection is, on the one hand, the density and compactness of arrangement of the rather firm corneal fibrillae which permit only small amounts of fluid in the interstitial spaces, and, on the other hand, the constant flow of lacrimal fluid which cleanses mechanically and which, through its lysozym content, also has some bactericidal power.

It may be surprising, therefore, that under certain circumstances the resistance of the corneal parenchyma is considerably diminished and that this diminution is due to general metabolic and nutritional disturbances.

CONDITIONS OF LOWERED CORNEAL VITALITY

Various groups of conditions will be discussed in which a lowered corneal vitality and lack of resistance to external damage and infection have been observed.

CASES OF LAGOPHTHALMOS

1. In some cases of complete lagophthalmos, the cornea may remain intact. This is especially true in those instances in which the facial nerve has been severed during operations on the ear or parotid gland. In these cases, the cornea may remain completely exposed during sleep and yet, surprisingly, no hyperemia of the bulbar conjunctiva, no corneal damage, nor increased lacrimal flow develops. Facial paresis from other causes leads more frequently to keratitis e lagophthalamo. Rheumatic facial paresis, however, is soon followed by excessive lacrimation which prevents the drying out of the cornea and the development of lagophthalmic keratitis in a high percentage of cases without other preventive measures.

In some contrast to the above mentioned causes of lagophthalmos there is the congenital, often familial ptosis, with shortness of the upper lids, which prevents complete closure of the palpebral fissure. These patients frequently require a ptosis operation. Great care should be exercised to elevate the upper lid just enough

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to enable the patient to look straight ahead without having to throw his head backward, because due to the preëxisting shortness of the lids the postoperative lagophthalmos is considerable and leads often to lagophthalmic keratitis in later years. In common cases of ptosis, the postoperative lagophthalmos is of such low degree that it does not often cause complications even in later life.

In all types and degrees of lagophthalmos, even the most complete, the innate vitality and great resistance of the cornea may prevent corneal complications. It is different if the lagophthalmos is associated with general debility and nutritional disturbances, as illustrated by the following cases.

Case 1. A woman, aged 20 years, received antisyphilitic therapy with Salvarsan. Almost immediately she developed a generalized dermatitis and was placed in the continuous bath. Gradually the severely damaged skin was replaced by fine, diffuse, shiny, pink scar tissue, which caused some shrinkage of the lids and a slight lagophthalmos of about 1 to 1.5 mm. In spite of this low degree of lagophthalmos and a normal Bell's phenomenon, bilateral lagophthalmic keratitis with rapidly progressing ulceration developed. Because of the skin condition neither bandage nor moist-chamber dressing was tolerated. One eye was lost following perforation of the ulcer and endophthalmitis; the other eye retained some useful vision in spite of perforation of the ulcer and iris prolapse. During the same period in which I observed this case, two similar cases of corneal destruction after Salvarsan poisoning were reported, one by Hegner¹ the other by Erggelet. Both² patients had severe Salvarsan dermatitis which ended lethally. In one patient, the cornea melted away completely; in the other, circumscribed defects developed which became epithelialized again. In neither pa-

tient was lagophthalmos mentioned, although it probably was present but of such slight degree that it was overlooked by the dermatologist.

Such rapid dissolution of the cornea does not occur in the ordinary cases of mild lagophthalmos, unless a severe nutritional disturbance due to poisoning and general debility is associated with it.

Another kind of low-grade lagophthalmos is not unusual in moribund patients. Although usually not more than 1 or 2 mm. of the cornea are exposed, lagophthalmic keratitis is not too rare in these patients. Most of the histologic specimens of this condition in my collection are from such patients. Perforation of these ulcers is rare, as the patients usually die before it occurs. The following case is of this type, and will be discussed in detail because it proves that it is indeed the general debility which predisposes to this rapid corneal disintegration and because it gives some useful hints for effective therapy.

Case 2. A man, 58 years of age, suffered a severe attack of pneumonia in addition to a nervous disorder with disturbances of equilibrium. When I first saw him, he was completely apathetic and was lying as if moribund with incompletely closed palpebral fissures. There was marked bilateral ciliary injection of the lower bulbs, and corneal infiltrates (1 by 3 mm.) had developed near the lower limbus in both eyes. Therapy for two weeks with atropine, oxycyanate of mercury (1:4,000 solution), and boric-acid ointment did not improve the ocular condition. The general condition of the patient also remained unchanged. I then ordered daily intramuscular injections of Vogan (vitamin A). When I saw the patient again a week later, he was sitting up in bed; the bulbs were pale, and shiny facettes had replaced the former corneal infiltrates.

This case of lagophthalmic keratitis in a critically ill patient responded strikingly to intramuscular vitamin-A therapy although no outward signs of avitaminosis were present. The severe illness had caused general nutritional disturbances in spite of the adequate food intake. The injections proved strikingly beneficial not only upon the ocular but also upon the general condition.

CEREBRAL HEMORRHAGE AND CORNEAL DISEASE

2. A different type of corneal disease is illustrated by the following case.

Case 3. An old woman had suffered a cerebral hemorrhage followed by paralysis of the right side. There was marked general debility and severe pulmonary congestion due to myocardial degeneration. There was a marked spastic entropion of the lower lids, and in the right eye the inverted cilia had caused a corneal perforation with iris prolapse and purulent iritis instead of the superficial keratitis more common in this condition.

In this case the severe general disease had led to the unusual complications of corneal perforation and iris prolapse in a spastic entropion. There was, apparently, not only an unusual lack of resistance of the corneal stroma but also a decreased corneal sensitivity; otherwise, the patient would have directed the attention of the attending physician toward the eye sooner.

MARANTIC CORNEAL ULCERS

3. Marantic ulcers of the cornea are closely related to the above mentioned cases. These ulcers develop in debilitated patients with such severe hepatic diseases as carcinoma or cirrhosis. They are flat, rather torpid ulcers, which do not change their appearance rapidly, cause only mild ciliary injection, and are accompanied by a stringy conjunctival secretion. The bul-

bar conjunctiva has often the appearance of tissue paper and, occasionally, Bitôt's spots, which have the appearance of dried soap foam, develop in the interpalpebral area, just as in keratomalacia and hemeralopia. These patients are usually icteric and their scleras are yellow. In severe cases, such marantic ulcers may lead to destruction of the cornea.

The corneal lesions in the two groups of cases described above are not due to lack of vitamin A in the food but to lack of utilization of the ingested vitamin. There appears to be a barrier between the intestinal tract and peripheral organ and intramuscular administration of vitamin A would seem to be a logical and promising therapy.

KERATOMALACIA

4. Closely related to the marantic ulcer is keratomalacia. It is mostly a disease of poorly nourished, ill, and weakened babies, and therapy with vitamin A is general.

It is considered by many, and in my opinion justifiably so, as a primary necrosis of the corneal lamellae with secondary invasion of bacteria from the conjunctival sac. Such eyes appear dry; the lacrimal fluid is diminished and its mechanically cleansing and bactericidal influence is, therefore, lacking.

The cause of this nutritional disturbance of the cornea is a generalized metabolic disturbance, often not a real lack of vitamin A but a lack in certain tissues of proper utilization of the vitamin and its metabolic derivatives. In the eye, the bulbar conjunctiva, cornea, and pigment epithelium are affected. The conjunctiva becomes dry and looks like wrinkled tissue paper, and Bitôt's spots appear. In the cornea, there develops a large, rapidly disintegrating infiltrate; the disturbance of the pigment epithelium manifests itself in hemeralopia. The finer and rarer lesions,

such as pigmentation of the cornea and white punctate lesions of the fundus, will not be discussed here.

A patient, whom I saw and treated in 1927, at a time when no parenteral vitamin therapy was as yet available, demonstrated that at least in some cases lack of utilization of the vitamin and not lack of its ingestion is responsible for keratomalacia.

Case 4. A baby, six weeks of age, was fed partly with mother's milk, partly with cow's milk, and looked well in general. Four days prior to the first visit, bilateral opacities were noted. At the time of this visit, there was already a small perforation in the lower half of each cornea and marked xerosis of the conjunctiva. Ultra-violet irradiation of back and abdomen was begun immediately, at first for three minutes a day at a distance of 60 cm. The feeding remained the same. Gradually the time of irradiation was increased. On the fifth day, the mother's breasts and the cow's milk were also irradiated. Within three weeks, the conjunctival xerosis had disappeared, the ulcers were healed, the anterior chambers restored, and the child, who had also suffered during this time from severe bronchitis, had gained 700 gm. It appears that the amount of vitamin already present in the milk became somehow activated and effective through the irradiation.

Another illustration in favor of poor utilization of the vitamin rather than its actual lack is the distribution of keratomalacia in India. I found keratomalacia widely distributed throughout Asia, from Palestine to Japan, occurring sometimes in children 5 and 6 years of age, but mostly in babies. In Japan about 20 per cent of blindness is due to this disease. However, in the state of Mysore in India, which is an especially well-governed district where one gets the impression of a high standard of living, keratomalacia is not infrequent in pregnant women or soon after parturition. These women of-

ten lose the sight of both eyes, while their babies develop neither xerosis nor keratomalacia. They frequently do not belong to the poorer classes and seem well nourished. I have neither seen nor heard of similar cases in any other province of India.

These cases show clearly, in my opinion, that there is not merely a simple lack of vitamin A, but a disturbance in the utilization of the vitamin. The ulcer in keratomalacia is not characterized by invasion of any one type of bacteria; therefore, the assumption that one is dealing primarily with a nutritional disturbance of the cornea as the consequence of a general metabolic disturbance is justified.

BASEDOW'S DISEASE

5. In rare instances of Basedow's disease, the proptosis is so marked that the lids no longer cover the cornea, and lagophthalmic keratitis develops. In these cases one attempts to protect the cornea by a moist-chamber dressing, a tarsorrhaphy, or, in severe cases, by a tenotomy of the levator palpebrae in order to release the severely retracted upper lid.

The severest degrees of exophthalmos sometimes follow a thyroidectomy, appearing from two months to a year after the operation, and are often associated with papilledema, retinal lesions, and impairment of vision. In these cases it is indicated to remove the roof of the orbit and of the optic canal and sever the tendon ring of Zinn. The exophthalmos may diminish in the course of several months. Naffziger³ found in these cases a waxy and hyalin degeneration of the muscle fibers and some infiltration of the muscles with lymphocytes and plasma cells. In these cases the cornea is damaged not only through desiccation but also through a nutritional disturbance. The latter is partly general and partly local. It is caused by the marked exophthalmos which is accompanied by severe chemosis

and swelling of the lids. The cornea may melt away rapidly in spite of a moist-chamber dressing, and it is in these seemingly hopeless cases that Naffziger's operation may be advised.

Case 5. A woman, 35 years of age, suffered from Basedow's disease and had lost 30 pounds. Professor Kaspar, who performed the thyroidectomy, found part of the gland liquefied and the fluid, which was under pressure, spouted a meter high after the section. During the night following the operation, severe dyspnea necessitated a tracheotomy. Several months after the operation, the already proptosed eyes became still more prominent and a tarsorrhaphy was performed. This was not tolerated by the patient for long, as the chemosis and exophthalmos increased further. The left cornea melted away rapidly and, in the fourth postoperative month, the right cornea also began to show infiltration in spite of a meticulously applied moist chamber and therapy with Vogan and pituitary preparations. At this stage, I saw the patient for the first time. There was maximal proptosis and chemosis of the bulbar conjunctiva. In the right cornea, there was an ulcer 5 by 6 mm. in size, whose margins showed yellowish infiltration and whose floor bulged forward. The pupil was maximally dilated, but there was no hypopyon. The left cornea had already melted away, and the left eye was very soft. I advised irradiated milk and Anthithyreoidin. I heard later that the right ulcer perforated but did not progress so that portions of the cornea were preserved. The left eye developed an apphation of the cornea and became blind.

In this case I did not advise Naffziger's operation because the corneal damage was so advanced, had progressed so rapidly, and the corneal ulcer in the better eye was just about to perforate.

Undoubtedly the rapid disintegration of the cornea was partly the consequence

of the severe local circulatory disturbance, and partly due to the severe general toxic condition of the patient.

ECZEMATOUS CONJUNCTIVITIS

6. In very run down and anemic children, eczematous conjunctivitis sometimes leads to destructive corneal ulcers. These ulcers are not caused by infection, and it is difficult to explain them solely on an allergic basis, which presumably is the main factor in eczematous conjunctivitis. I often saw such corneal infiltrates and ulcerations in adults whose general health was below par. In these patients, who are usually quite anemic, underweight, and often have multiple lymphomas, the generally weakened physical condition seems to be responsible for a diminution of the resistance and vitality of the cornea, as the following case illustrates.

Case 6. A man, 40 years of age, sustained a severe pulmonary injury during the war and was operated for empyema. The patient was in a generally feeble condition and undernourished. There was eczema of the face and eyelids and a marked bilateral conjunctivitis, associated in the right eye with a corneal infiltrate and in the left eye with a small, deep, crater-shaped ulcer. The eczema was successfully treated with cehasol paste, the conjunctivitis with oxycyanate of mercury and novargan ointment, but the ciliary injection of the bulb remained the same in spite of intensive atropine medication, which did not succeed in dilating the pupil appreciably within two weeks. Finally, I ordered pyramidon, 0.2 gm., six times daily. After two days, the ocular condition had improved considerably; the eyes could be opened; the bulbs were pale; and the corneal ulcers were cleansed and epithelialized. The eczema of the face had disappeared completely. The pyramidon medication was discontinued, but within two days, the ciliary injection of the bulbs reappeared and the left, already epithe-

lialized, crater-shaped ulcer had perforated, leading to a small iris prolapse.

The condition of the eyes was such as one encounters not infrequently in cases of severe eczema of the face, and which resembles eczematous conjunctivitis. The fact that an ocular condition of this type is so refractory might be due to an altered mode of reaction of the entire ectoderm of the body. The unusual and late perforation of the already cleansed ulcer was probably not due to allergy but to a diminished vitality of the cornea in the course of the debilitating general illness. In this case the prompt effect of the cumulative doses of pyramidon is also noteworthy.

In the therapy of eczematous keratitis, one obviously has to distinguish between measures which are directed against the allergic condition of children and adolescents, in whom often a simple foreign body elicits a typical attack of eczematous conjunctivitis with phlyctenules and pannus, and the general hygienic measures as mud and seabaths, and cod-liver oil, iodine, iron, and quinine medication which, by raising the general physical resistance, also increase the vitality of the cornea.

DISCUSSION

In these six groups of cases there is a diminution of corneal resistance due to a general weakening of the connective tissue of the body, and it is interesting to point out analogous conditions in other parts of the body.

There is the reopening of the postoperative wound and evisceration after abdominal surgery. Large, collective statistics show that this occurs in 2 to 3 percent of all laparotomies, and is almost twice as frequent in men as in women. It occurs predominantly in patients who suffer not only from the current surgical condition but also from general cachexia, acute or chronic toxic conditions, or considerable

anemia (Hofstätter⁵). Other predisposing diseases are diabetes, syphilis, and avitaminosis. Many authors have reported this surgical complication as occurring in years of famine and as more frequent at certain times of the year, late winter and early spring, when nutrition becomes poorer. Only in rare instances is this reopening of abdominal wounds ascribed to faulty suturing technique or inferior suture material. Most authors believe that a diminished "tissue tone," delayed healing tendency, or "tissue paralysis" due to general debility are responsible for it.

I believe that there is an inherent weakness, fragility, and striking lack of resistance of the connective-tissue fibrillae rather than an absence of healing tendency.

The frequent occurrence of hernias in times of famine has a similar pathogenesis; that is, general damage to the connective tissue apparatus. These hernias have become very common during the past few years and often occur in people who have remained physically fit through continuous gymnastic exercise. Many surgeons consider the rapid and considerable loss of weight and the consequent loss of lipoid tissue in the abdominal wall as the cause of these hernias. It is, however, not very obvious how lipoid tissue should strengthen the abdominal wall to such an extent. It is more probable that, in the course of marked loss of weight due to malnutrition, the connective-tissue fibers are weakened and that this leads to thinning and dehiscences especially in such places of naturally weaker resistance as the inguinal canal. The pathogenesis of the above discussed manifestations of corneal and of general disease appear to be the same; namely, a striking diminution of the vitality of the connective-tissue apparatus.

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SCLERAL NECROSIS IN PERIARTERITIS NODOSA

A CASE REPORT*

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AND

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Periarteritis nodosa was first described by Rokitsansky in 1852.¹ In 1866, Kussmaul and Maier described the gross and microscopic pathology of the disease. Since that time more than 550 cases have been reported and of these only 10 percent exhibited ocular involvement.^{2,3}

Goldsmith has recently reviewed the ocular signs of periarteritis nodosa.⁴ These include papilledema with optic atrophy, involvement of the choroidal vessels, involvement of the retinal vessels with the formation of fusiform aneurysms, retinitis with retinal detachments, hemorrhages and exudates, recurrent vitreous hemorrhages, and involvement of the extraocular muscles.⁵⁻¹¹ A survey of the literature reveals no report of scleral necrosis occurring in the course of this disease.

REPORT OF A CASE

G. H., aged 31 years, was first admitted to the U. S. Naval Hospital at Philadelphia on April 11, 1946, with the complaint of weakness, headache, and anorexia. The

present illness apparently began two years prior to admission when the patient, an enlisted man in the Army, developed an acute otitis media and abscess of the nasal septum. While under treatment with sulfonamides, the patient developed what was thought to be an allergic reaction to them. One blood culture out of many prior to treatment was reported positive for hemolytic staphylococcus aureus. The patient recovered from this acute episode with considerable nasal saddleback deformity due to loss of cartilage, chronic right dacryocystitis, and deafness, which necessitated the use of a hearing aid. In February, 1945, he developed an interlobar collection of fluid in the right chest and an exacerbation of chronic dacryocystitis. Cultures and guinea-pig inoculations of the pleural fluid were reported negative. Both lesions cleared with penicillin therapy, and the patient was asymptomatic until just prior to admission.

PHYSICAL EXAMINATION

Positive findings on admission were an interlobar collection of fluid in the right chest, chronic right dacryocystitis with fistula formation, marked saddleback de-

* Read at College of Physicians of Philadelphia, Section on Ophthalmology, October 24, 1946.

formity of the nose, large perforation of the nasal septum, and marked atrophy of all turbinate tissue with nasal crusting and tendency toward spontaneous epistaxis. The right ear drum was markedly retracted with recent vascularization, and the left drum showed an old perforation with adherence of the drum margins to the medial wall of the middle ear. Re-



Fig. 1 (Harbert and McPherson). Right eye. Showing extensive, sharply demarcated, superficial necrosis surrounded by chemotic conjunctiva. Cornea clear.

peated sputum examinations were negative for tubercle bacilli and careful study showed no evidence of active pulmonary infection. Vision was: O.D., 20/20; O.S., 20/15. No pathologic condition of the eyes was noted. The patient desired a nasal plastic operation, and a dacryocystectomy with excision of the fistulous tract was performed on May 1, 1946, as a preliminary to rhinoplasty.

COURSE

The immediate postoperative course was uneventful; the wound apparently healed by primary intention, and sutures were removed on the fourth postoperative day. At this time the patient developed edema of the right eyelids. On the seventh postoperative day, he developed photophobia, lacrimation of the left eye, and a bilateral, superficial, punctate keratitis which persisted in spite

of local treatment with hot compresses and the administration of intravenous typhoid vaccine. On the 14th postoperative day, the patient developed a spontaneous subconjunctival hemorrhage in the right eye at the 1-o'clock position, just outside the limbus. The following day this lesion became edematous, and a similar lesion appeared in the left eye. Within 48 hours, both lesions ulcerated, and the patient developed spontaneous epistaxis. Smears and cultures were taken from both lesions for aerobic and anaerobic bacteria, acid-fast bacilli, and fungi. These were all repeatedly negative except for an occasional colony of diphtheroids. Direct scrapings were taken from both lesions and the nasal mucosa and stained for tubercle bacilli and ordinary bacteria. These were likewise negative.

The conjunctival and scleral necrosis continued to progress until a "porcelain white," completely avascular slough developed (figs. 1 and 2). The patient was treated locally with penicillin drops and systemically with 30,000 units of penicillin every three hours. There was very little change in the patient's condition, although 21 days after the onset of the ocular disease, an occasional vessel could be seen appearing in the area of the



Fig. 2 (Harbert and McPherson). Left eye. Similar lesion of left eye.

slough. One month after the onset, the patient was given streptomycin (2 gm. daily for 5 days), with no apparent effect on the slow healing process. After cessation of the streptomycin, the patient became febrile, spiking a temperature of 99° to 100°F. at irregular intervals. Repeated blood cultures taken during the febrile period were negative.

At this time the eyes first showed some definite evidence of improvement. Conjunctival epithelium began to cover the scleral sloughs which had become so deep that uveal pigment could be seen shining through. At the same time, from the marginal conjunctiva, vessels began to invade the sloughing sclera and adjacent cornea to form a superficial pannus (fig. 3). The patient complained of paresthesia of both hands and developed a persistent eosinophilia of 8 to 10 percent, albuminuria (1 plus to 3 plus), and microscopic hematuria. The sedimentation rate was



Fig. 4 (Harbert and McPherson). Right eye. Showing early stage of secondary scleral nodule.

PATHOLOGIC REPORT

The pathologic report of T. W. Bennett, Comdr. (MC), U.S.N.R. is as follows.

Sections from the gastrocnemius were studied (fig. 5). In areas in the muscle fibers, there was evidence of low-grade inflammatory change. In one area between the muscle fibers, there were cross sections of several small blood vessels. These vessels were identified as arterioles. In one, there was practical occlusion of the lumen of the vessel. The intima appeared to be missing, and there was an apparent thrombosis with beginning canalization. About this area, there was proliferation of connective tissue and a zone of round cells, polymorphonuclear leukocytes, plasma cells, and occasional eosinophiles. In another area there appeared to be complete thrombosis and organization resulting in fairly dense fibrous tissue. About this area there was evidence of chronic inflammation. Another vessel was seen which appeared to have proliferative changes in the intima and subintimal area. About this area there was a moderate amount of chronic inflammatory change characterized especially by the presence of plasma cells. It is believed



Fig. 3 (Harbert and McPherson). Right eye. Showing superficial pannus vessels and vascularization of central area of slough.

27. Blood Kahn and spinal-fluid examinations were negative. In view of these findings it was thought advisable to perform a muscle biopsy to exclude periarteritis nodosa. This was done in the seventh week of the ocular disease.

that these sections represent three stages: (1) Beginning proliferative changes in the intima, (2) complete thrombosis with occlusion of the vessel, and (3) complete thrombosis with beginning canalization of the thrombotic area. These findings are

ophthalmoscope and slitlamp. The vitreous now became hazy, and a beam without cells appeared in the anterior chamber, 11 weeks after the onset of ocular symptoms. Shallow necrotic ulcers also developed on the buccal mucosa. Multiple

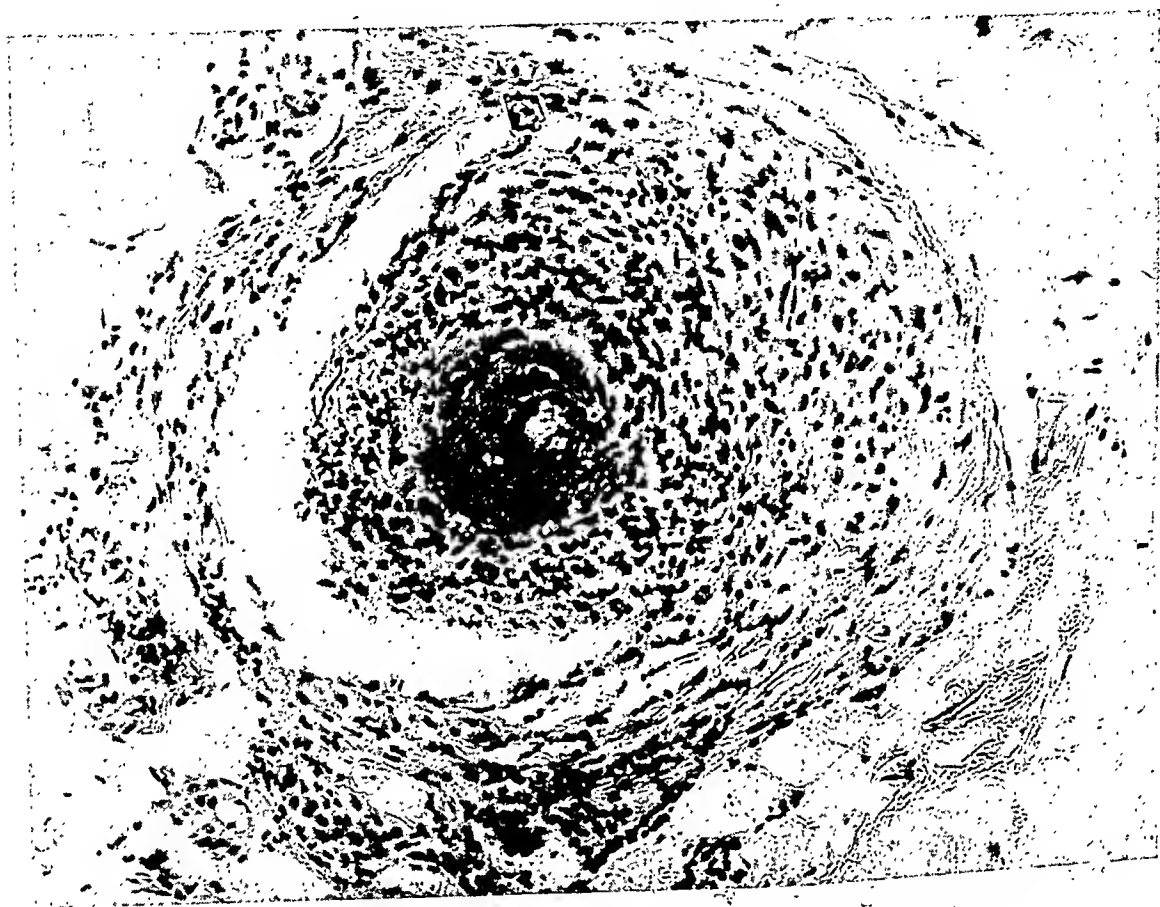


Fig. 5 (Harbert and McPherson). Typical periarteritis in muscle biopsy.

consistent with those occurring in periarteritis nodosa.

SUBSEQUENT COURSE

In the eighth week of the ocular disease, the patient developed redness, pain, and swelling of the right ankle which was considered due to vascular occlusion followed by a similar lesion of the left wrist in the 10th week. The wrist lesion suppurated. The corneoscleral lesions relapsed, the necrosis extending into the cornea. Prior to this time, the ocular media were clear to repeated examinations with

vitamins, including riboflavin, failed to influence the course of the disease. Twelve weeks after the onset of ocular symptoms, the patient developed intradermal nodules on both feet and legs. Biopsy of one of these showed typical lesions of periarteritis nodosa (fig. 6). This diagnosis was confirmed by Dr. Arnold R. Rich of Johns Hopkins Hospital.

Fundus details were not now visible. The margins of the original scleroconjunctival slough were not healed, but the central portion showed a thin scar with uveal pigment showing through. The up-

per margin of the cornea developed superficial sloughs which coalesced to form an ulcer with an overhanging edge extending toward the central portion of the cornea in the manner of a Mooren's ulcer.

superficial slough at the site of injection. Intradermal desensitization with 1:1,000 staph toxin was given for a month with no evidence of favorable response, and the patient was discharged from the hos-



Fig. 6 (Harbert and McPherson). Typical periarteritis with thrombosis in skin biopsy.

There was scattered, superficial, corneal vascularization. Both corneas became edematous. The left eye developed several large keratic precipitates. Vision was: O.D., 1/200; O.S., 2/200.

Since the patient had responded to no other therapy, and in view of the previously reported positive blood culture for staphylococcus aureus, the patient was tested intradermally with staphylococcus toxin to determine his sensitivity. He was found to be mildly positive to 0.1 cc. of 1:1,000 dilution; and very markedly positive to 0.1 cc. of 1:100 dilution. With the 1:100 dilution, the patient developed a

pital at his own request 15 weeks after the onset of the ocular disease.

COMMENT

A clinically similar type of ocular lesion has been described as anterior metastatic scleritis. According to Duke-Elder, this is usually due to a staphylococcal embolus (90 percent), but occasionally is due to pneumococci.⁵ In a few cases, no organisms were found.

The fundamental pathologic change in periarteritis nodosa is inflammation of the medium and small arteries with fibrinoid hyaline necrosis and exudative processes.

As the necrotizing process subsides in one organ, it may involve another with remissions and relapses. Many etiologic explanations have been suggested but the most widely accepted one is that it is not a disease entity, but a hypersensitivity of the arterial walls. It is most often related to a bacterial allergy in chronic infections, but experimental evidence indicates that drugs, foreign proteins and serums, and even foods or pollens may be responsible. Since the widespread use of the sulfonamides, the number of cases reported has

increased markedly. These drugs are presumed to act as haptens, combining with plasma proteins to form allergens.²

SUMMARY

A case of scleral necrosis occurring in the course of periarteritis nodosa is reported and discussed. No treatment was of any avail despite the establishment of the diagnosis early in the course of the disease.

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NEUROBLASTOMA OF THE ADRENAL WITH ORBITAL METASTASES*

REPORT OF FIVE CASES WITH AUTOPSY FINDINGS

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The purpose of this paper is to add to the ophthalmic literature five proved cases of neuroblastoma of the adrenal with orbital metastases and to record the therapeutic failure of radioactive phosphorous as a method of controlling this fatal tumor of childhood.

HISTORICAL REPORT

Sympathetic neuroblastomas of the adrenals were recognized by Marchand¹ in 1891, who described them as being of neural origin. In 1910, Wright² confirmed Marchand's findings and established the tumors as clinical entities. Meanwhile two distinct clinical types had been described. In 1901, Pepper³ reported an adrenal tumor which he called a congenital sarcoma that invaded the liver and regional lymph nodes, causing stillbirth or death in early infancy. In 1907, Hutchinson⁴ described a similar adrenal tumor in children up to 15 years of age, but which metastasized early to the orbit, meninges, skull, and long bones. It is this, the Hutchinson type of neuroblastoma, which is of particular interest to the ophthalmologist.

CLINICAL PICTURE

The most common symptom which brings these patients to the ophthalmologist is a recurrent area of ecchymosis about one or both eyes, often thought to be of traumatic origin. This ecchymosis is soon accompanied by a firm, bony swelling somewhere about the orbit, which frequently results in proptosis and dis-

placement of the globe, and which may reach the proportions of a malignant exophthalmos. Corneal ulceration and secondary infection can cause the loss of an eye.

Early in the disease, the primary tumor is rarely palpable. Enlargement and extension to adjacent lymph nodes frequently produce an upper abdominal tumor later. Metastases are commonly found in the skull and long bones, but their presence in liver, lung, lymph nodes, and so forth emphasizes the lack of a clean-cut differentiation between the "Pepper" and "Hutchinson" types. Subjective symptoms depend on the location of the metastases. If these occur in the skull, increased intracranial pressure is common, with headache, nausea, vomiting, choked discs, separation of suture lines of the skull bones, and hydrocephalus. If metastases appear in the vertebrae and long bones, pain may occur in the back and extremities. One case⁵ has been reported with multiple skin nodules present at birth. No sexual changes are ever noted such as are found in tumors of the adrenal cortex. General symptoms of weight loss, pallor, low temperature elevation, anemia, and a low leukocytosis are present.

A provisional diagnosis of neuroblastoma can be made from these symptoms. Confirmation must be obtained by biopsy and by X-ray studies. Biopsies can be taken from any area of metastasis or from the primary growth. X-ray studies of the involved bones show multiple, tiny foci of resorption, giving a finely granular osteoporosis with uneven density of the skull and pelvis. There may be local or

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extensive involvement of the long bones with elevation of the periosteum and metastatic areas of resorption in the ends of the diaphyses adjacent to the epiphyseal lines. Pyclograms show a normally functioning kidney often displaced downward. An important finding that is not usually mentioned is the presence of flecks of calcification in the primary tumor just above the pole of the left kidney.

ETIOLOGY AND PATHOLOGY

Embryologically the medulla of the adrenal gland is formed by the undifferentiated nerve cells of the primitive sympathetic nervous system. It is a failure on the part of these cells to mature that results in neuroblastoma of the adrenal. Although congenital, the time of onset of symptoms may be delayed as much as four years after birth, varying with the malignancy and the location of the metastases in the individual case. In the Hutchinson type, the tumor is in the left adrenal gland. Since the liver and lungs may both escape involvement, metastases are thought to spread by way of the fetal blood and lymph circulation. The only other alternative would be the spontaneous development of multiple primary tumors in various parts of the body.

Pathologically the tumor is made up of firm pink tissue, which cuts with a gritty feel, due to areas of calcification. The surface is mottled by hemorrhagic areas, as one would expect in a neoplasm of so vascular an organ as the adrenal. The thin-walled capillaries are the source of the orbital ecchymoses which so often are the first sign of the disease. The cells tend to be small and round, with dense hyperchromatic nuclei and but little cytoplasm. These are similar to the primitive migrating cell of the sympathetic nervous system. A few larger round cells with vesicular nuclei, and some pear-shaped cells

resembling spongioblasts can be seen. In 30 to 50 percent of specimens, the small cells group in solid masses or hollow spheres, called "rosettes." All the cells give off delicate processes which unite to form a fibrillar syncytium (fig. 3).

Although the usual microscopic picture is conclusive, it may be very confusing. As stated by Wahl:⁶ "Because the adrenal neuroblastomata are so malignant and composed of the sympathetic formative cell, any transition may be present between the primitive cell and chromaffin and ganglion cells." The various transitions may cause parts of the tumor to resemble glioma, scirrhous carcinoma, lymphosarcoma, or sarcoma. For years the tumor was thought to be a retroperitoneal sarcoma. Two of our five cases were misdiagnosed after a biopsy had been studied. It is, therefore, important that the entire clinical picture be considered, and that a microscopic diagnosis be obtained from competent pathologists.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis of neuroblastoma may be difficult due to the varying areas of metastatic involvement and to the infrequent finding of an abdominal tumor. The age group of the patients, in itself, limits the diagnostic possibilities. Careful blood studies will differentiate neuroblastoma from the blood dyscrasias which can produce ecchymosis and proptosis. However, aleukemic leukemia can produce a similar bony resorption in the skull without characteristic blood findings. Scurvy causes ecchymosis and X-ray studies of rickets will show subperiosteal proliferation. The dietary history and general physical findings should eliminate these diseases, however. Hemangiomas about the orbit will not produce this type of X-ray picture. Chloroma is a tumor which involves the flat bones, but its diagnosis is relatively easy because of a typical

microscopic and blood picture. Other neoplastic diseases are rare in children.

COURSE OF THE DISEASE

The disease progresses steadily, irrespective of therapy. Pain is usually not severe and often is entirely absent. New metastatic foci appear, and the old areas continue to enlarge. Weakness and anemia become more prominent. As is common in neoplasms of children, the general health remains fairly good, with rapid failure in the few weeks before death. Patients rarely live more than one year after the first symptoms appear. Farber⁷ reported that 10 out of 40 patients with neuroblastoma were alive 3 to 8 years after diagnosis had been made, but these patients did not have the Hutchinson type. He states that in every case with skull metastases, death resulted.

TREATMENT OF THE DISEASE

X-ray therapy has been the only agent of any particular value in controlling neuroblastomas, and its effects have been temporary. To my knowledge, radioactive salts have not previously been used in this condition. Two cases of the five herein reported were treated with radioactive phosphorous in the form of sodium hypophosphate which had been prepared in the cyclotron of the University of California. Case 1 was given large doses of the radioactive salt by mouth, a total of 5.3 milluries being given without effect. Case 2 was given a large single dose of radioactive phosphorous, intravenously. If tumor cells selectively pick up these salts, large concentrations can be demonstrated over the site of the tumor by the Geiger counter. In this patient, results were encouraging the first day. The count of radioactivity showed a definite concentration over the tumor site on the right orbit as compared to the control area on the left orbital rim. This initial difference rapidly diminished. By the next day, radioactivity

was the same on one side as on the other. The initial difference was thought to be due to the increased vascularity of the tumor area. This type of treatment is of no value unless the salts are stored in the tumor cells, as occurs in thyroid cells when radioactive iodine is injected. The use of radioactive phosphorous in the treatment of neuroblastomas must, therefore, be recorded as a failure in these two cases.

X-ray treatments are of great help in controlling the size of the individual metastatic lesions. Their use may avoid a progressive exophthalmos which can cause the loss of an eye as occurred in two of the six reported cases. X-ray therapy also has an immeasurable psychologic value both for the parents and the patient, even though it may not prolong life. Deep X-ray therapy is usually applied in divided dosages over a period of two months. The tumor should be irradiated from two directions, each field receiving a total of 2,000r to 3,000r. Treatment other than X ray is entirely palliative. The anemia which appears in the later stages of the disease can be benefited by treatment with iron and liver, and by blood transfusions, though these only postpone the inevitable outcome.

CASE REPORTS

Of the six cases of neuroblastoma reported, five were of the Hutchinson type, and one, Case 6, proved at autopsy to be a neuroblastoma whose origin was high in the cervical sympathetic chain. In all six cases, ecchymosis about the orbit and proptosis were present, and they were the presenting complaints in two cases. Two of the six patients eventually lost an eye because of extensive exophthalmos. Ages in this group varied from 4½ months to 4 years. One patient lived 2½ years after the onset of symptoms, but the others died in 4 to 12 months.



Fig. 1 (Shaffer). Case 2. Neuroblastoma of the left adrenal with metastasis to right orbit.

CASE 1

History. G. A. R., a white boy, aged 10 months, had as chief complaint a mass in right upper quadrant. His history showed that he was jaundiced for five days postpartum and had a rather large head. At the age of four months, he developed a slight difficulty in breathing, and at six months, a mass in the right upper abdominal quadrant was palpated. In the next three months, ecchymotic areas appeared about both eyes, and lumps developed on both temples and on the left shoulder.

Physical examination showed ecchymotic areas about the right eye and subconjunctival hemorrhages in both eyes. A large, firm abdominal tumor mass could be palpated in the right upper quadrant, and a small one was noted in the left supraclavicular fossa.

Laboratory findings. Blood tests. re-

ported: Red blood corpuscles 3.8 million; hemoglobin, 84 percent; white blood corpuscles, 8,000; normal distribution. Urine tests were negative.

X-ray studies showed moth-eaten areas in both frontal bones, in the intertrochanteric area of the left femur, and in both tibiae. No calcification was seen in the abdominal mass. A biopsy of the supraclavicular mass revealed neuroblastoma.

Course of the disease. Doses of 700r of X ray were given to the frontal area. Metastases increased in size and in number. Proptosis developed. Hemoglobin dropped from 85 to 54 percent. Large doses of X ray seemed to have no effect on the tumor. A total of 5.3 millicuries of radioactive phosphorous was given by mouth without improvement. The patient died one year after onset of symptoms. At autopsy it was seen that the tumor was seeded throughout skull, long bones, a few ribs, and the abdominal and thoracic lymph nodes. In this case the liver was also heavily invaded, and there was scattered invasion of the pancreas. Microscopically, the cells were typical of neuroblastoma.

CASE 2

History. T. F., a three-year-old white boy, was seen because of recurrent subcutaneous ecchymosis of the right eye.

Physical examination revealed a low, rounded swelling of the right frontal bone extending from the lateral orbital rim halfway up the forehead. The eye was slightly proptosed, and pushed downward and inward. A faint ecchymosis of the right upper lid could be seen. No diplopia could be elicited. The fundi were normal.

Laboratory findings. A blood count showed red blood corpuscles, 3.69 million; hemoglobin, 75 percent; white blood corpuscles, 13,700 normal distribution. Urine tests were reported negative.

X-ray studies revealed a roughening and thickening of the right superior orbital rim, with small areas of rarefaction in the frontal bone. A bone survey was otherwise negative. Above the left kidney, which was normal by intravenous pyelography, was a $1\frac{1}{2}$ by 1 cm. ringlike calcification. The lungs were slightly hazy.

The clinical diagnosis was neuroblastoma of the left adrenal.

Course of the disease. The left adrenal was removed surgically to prevent further metastases. No local metastases were noted. Grossly and microscopically the tumor was typical of a neuroblastoma.

Radioactive phosphorous was injected intravenously, but no selective retention of the salt by the tumor was shown. Deep X-ray therapy to the skull resulted in a

definite shrinkage in the size of the tumor mass. Six months later, a similar mass in the left temporal fossa responded similarly to X ray. Terminally, a progres-



Fig. 2 (Shaffer). Case 2. Adrenal tumor after surgical removal.

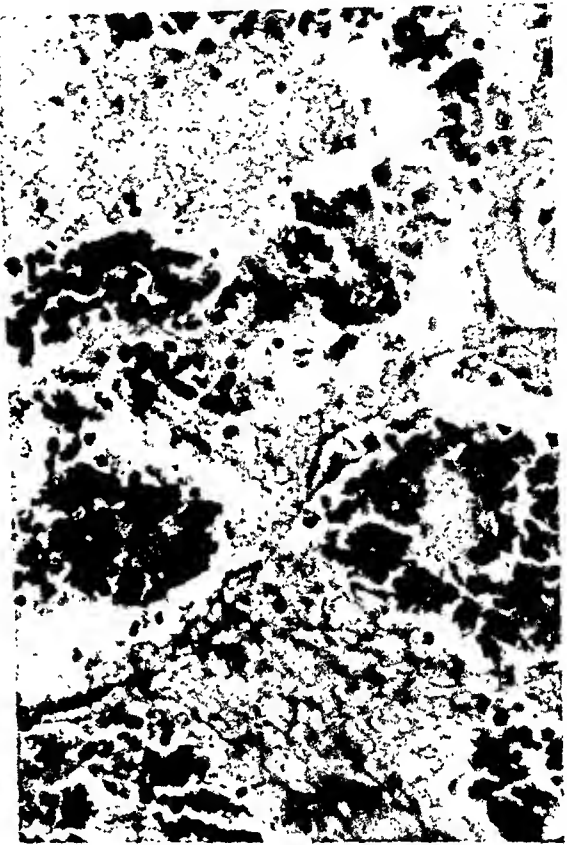


Fig. 3 (Shaffer). Photomicrograph of neuroblastoma showing rosettes.

sive anemia developed with low fever and weakness. The patient died suddenly one year after the onset of symptoms.

CASE 3

History. P. B., a girl, aged $3\frac{1}{2}$ years. After a normal infancy, the patient began to have an intermittent fever of 103°F . four months before entry. She complained of pains in the neck and legs.

Physical examination. A firm mass was felt in the left upper abdomen; otherwise the examination was negative.

Laboratory findings. Blood tests showed: red blood corpuscles, 3.2 million; hemoglobin, 60 percent; white blood corpuscles, 7,800; distribution, normal.

Urine, spinal fluid, tuberculin test, blood cultures, and various agglutination tests were all negative.

X-ray studies showed a rarefaction and some periostitis of both femora and humeri. A ringlike area of calcification, 3 by 4 cm. in size, was seen in the abdomen just lateral to the left lumbar spine between the 11th and 12th posterior ribs.

A bone-marrow biopsy reported: blasts, 1.6 percent; myelocytes, 0.4 percent; metamyelocytes, 1.4 percent; nonfilamented, 2.4 percent; filamented, 0.6 percent; eosinophils, 0.2 percent; lymphocytes (mostly young), 89 percent; and nucleated red blood corpuscles, 4 percent. A lymph node biopsy was negative. The tentative diagnosis was aleukemic lymphatic leukemia.

Course of the disease. The intermittent fever continued. Some swelling about the eyes and on the legs appeared. Veins on the skull became prominent and a cracked-pot resonance of the skull could be obtained. The optic discs were found to be choked, with an elevation of about 3 diopters. X-ray pictures showed extensive separation of the skull sutures, mottling of the skull bones, and extension of long-bone involvement. A blood count showed 3.17-million red blood corpuscles with 55-percent hemoglobin; 10,000 white blood corpuscles; and normal distribution. Neuroblastoma of the left adrenal was proved at autopsy.

CASE 4

History. G. L. J., a boy, aged 20 months, was seen because of an intermittent rash and fever for 15 months. An erythematous rash first appeared on the face, neck, and chest at the age of five months. It was associated with a fever of 100° to 101°F. every few weeks and with a slight anemia.

Physical examination. A large firm mass could be palpated in the abdomen in

the left upper quadrant. Otherwise, the examination was negative.

Laboratory findings. Blood test reports: red blood corpuscles, 4.7 million; hemoglobin, 76 percent; white blood corpuscles 12,200; normal distribution. Urine tests were negative.

X-ray studies showed a partially calcified abdominal and retroperitoneal tumor which caused a bulge of the left psoas muscle and downward displacement of a normal left kidney.

Course of the disease. A large mass was removed from the abdomen. Lymph nodes along the vena cava were seen to be involved. The tumor cut with a gritty feel, and the cut surface was mottled yellow, red, and blue with small gritty particles of calcium scattered throughout. Pathologically the cells were typical of neuroblastoma.

One month after entry, rarefaction of the left frontal skull was seen by X ray, and deep X-ray irradiation was instituted. A total of 1600r was given front and back over the skull, lower mediastinum, and upper abdomen.

The patient was not seen for two years and was in good health during this time. Then, a 4 by 5 cm. swelling, lateral to the left eye, appeared, and the patient developed irritability, leg pains, and fever. The blood picture at this time was not remarkable. X-ray studies showed further rarefaction of the skull, left tibia, pelvis, and, perhaps, the vertebra and supra-orbital plate. Weakness increased, and he died 2½ years after the onset of the first symptoms.

At autopsy, many white nodules were found in the pancreas, right adrenal, preaortic and mediastinal nodes. The left adrenal had been removed in the previous surgery. The testes, dura, and skull bones, as well as the tibia were involved. Microscopically the cells were typical of neuroblastoma.

CASE 5

History. C. D., a girl, aged nine months, had shown dark areas around her eyes for two months.

Physical examination. Firm, bony swellings of the skull were present—two in the right occipital region, 2 by 2 cm. in size; one above the right ear 2 by 2 cm. in size, pushing the ear downward; and a 2 by 5-cm. mass in the left temporal region. Marked ecchymosis was present about both orbits, and there was pronounced exophthalmos, more marked on the right. The spleen could be felt 6 cm. below the costal margin.

Laboratory findings. Blood: red blood corpuscles, 3,28 million; hemoglobin, 70 percent; white blood corpuscles, 17,350; normal distribution. Urine tests were negative.

X-ray studies showed irregular destruction of the skull bones. The facial bones were practically destroyed. An osteolytic process was present in the lower three fourths of the tibia. The clinical diagnosis was chloroma.



Fig. 4 (Shaffer). Case 5. Neuroblastoma of left adrenal with multiple metastases.



Fig. 5 (Shaffer). Case 6. Neuroblastoma of cervical sympathetic chain.

A biopsy from one of the skull lesions was obtained, and a pathologic diagnosis of myeloma was made.

Course of the disease was steadily downhill. Both femurs and tibias showed extensive bony destruction, and the skull lesions progressed. Exophthalmos became more marked. A corneal ulcer, which appeared on the right eye, subsequently perforated. The child died two months after entry and four months from the time of onset of symptoms.

An autopsy revealed a typical neuroblastoma of the left adrenal with metastases to the regional retroperitoneal, iliac, and inguinal lymph nodes. Practically every bone in the body was riddled with tumor. A single nodule was present in the liver.

CASE 6

History. S. J., a 4½-months-old girl was seen because of the prominence of both eyes. At the age of 2½ months, she had developed a nasal discharge and occasional vomiting. At 3½ months, both eyes had become prominent, and fixed in the sockets.

Physical examination. Bilateral proptosis was present, more marked on the right, and there was no light reaction in

either eye. The fundus veins were engorged, the discs were elevated 2 diopters, and some exudate could be seen. The roof of the mouth appeared thickened. The fontanels were open and very tense. No abdominal mass was palpable.

Laboratory findings. Blood count was: red blood corpuscles, 5.4 million; hemoglobin, 70 percent; white blood corpuscles, 16,800; normal distribution. Urine tests were negative.

X-ray studies showed a total destruction of bone lying between the nasopharynx and the sphenoid, extending into the posterior ethmoid sinuses and the floor of the middle fossa on both the right and left sides. No signs of abdominal tumor were present. The provisional diagnosis was chordoma. A biopsy diagnosis was neuroblastoma. The revised diagnosis was neuroblastoma of the adrenal with metastases.

Course of the disease. The symptoms increased rapidly, and on terminal hospital entry, at the age of one year, the left eye was pushed completely out of the orbit onto the cheek, and was atrophic and desiccated. The right eye was pushed down and out. A baseball-sized mass filled

and protruded from the mouth. The child died 10 months after onset of symptoms.

At autopsy, no involvement of the adrenal was demonstrated. The lungs were studded with metastases. The whole central skull was involved in the tumor mass. Histologically, the tumor was demonstrated to be a neuroblastoma. Its origin was in the region of the superior cervical ganglion. The final diagnosis was neuroblastoma of the superior cervical sympathetic ganglion.

SUMMARY

Neuroblastomas of the adrenal gland of the Hutchinson type are discussed. Five case reports with autopsy findings are given. One case, with an identical clinical picture, had its point of origin high in the cervical sympathetic chain. Radiologic evidence of calcifications above the left kidney at the site of the primary tumor is an extremely important clinical aid in diagnosis. This finding has been insufficiently emphasized in the past. The use of radioactive phosphorus has been unsuccessful, up to this time, in the treatment of these cases.

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PAPILLEDEMA AND PAPILLITIS*

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The clinical and pathologic differences between papilledema and papillitis were clearly defined by Paton and Holmes¹ in 1911, but ophthalmologists are still debating the issue. In 1942, Bedell² reported six cases of papilledema without increased intracranial pressure. Lillie³ and Verhoeff⁴ raised the question as to whether Bedell's cases were really papilledema or optic neuritis, and the subject was fully discussed. The point is that as recently as 1942, there was still dissension as to the differential diagnosis between papilledema and papillitis.

In using the term papillitis. I refer to optic neuritis with involvement of the intraocular portion of the optic nerve so that exudates and hemorrhages are seen on and around the disc. This is in contrast to retrobulbar neuritis, which is optic neuritis of a more posterior portion of the nerve, and which, in the early stage, produces no ophthalmoscopic visible evidence. When optic neuritis is mentioned in this article, it means optic neuritis with papillitis.

When one is confronted with a swollen disc, hemorrhages, exudates, and venous engorgement, one must differentiate between papilledema and papillitis. Of course, if the history, the clinical and neurologic pictures, X-ray air studies, lumbar punctures, and electroencephalograms point to a definite intracranial mass, there is usually little or no problem—one is most likely dealing with papilledema. Such cases are not apt to cause confusion. It is in those early cases in which the studies are inconclusive that the ophthalmologist is faced with the problem of dif-

ferentiating between papilledema and papillitis. An early diagnosis of papilledema in such cases may help to bring early surgical intervention and, thereby, save life.

To help in this differential diagnosis, we must utilize the fundusoscopic picture, the study of visual acuity, and studies of the central and peripheral fields.

The differential diagnosis of papilledema and optic neuritis was well described by Aiken and Cordes.⁵ I wish to mention a few words about the fundusoscopic picture and to emphasize especially the importance of the visual-acuity and the field studies.

FUNDUSCOPIC PICTURE

Many of our recent textbooks contain valuable differential fundusoscopic pictures of papilledema and papillitis. However, I believe that many ophthalmologists will concede that the ophthalmoscope alone will not always give a clean-cut differential diagnosis. I have often found the application of these differentiating points rather difficult in the many cases of papilledema and optic neuritis seen at Montefiore Hospital. Not all cases of papilledema have the typical mushroom appearance of the swollen disc projecting into the vitreous. Many of the cases show a diffuse blurring of the disc margins caused by exudates extending into the peripapillary retinal layers, with hemorrhages or exudates, arterial narrowing, and venous engorgement. This produces a picture so much like optic neuritis that a differential diagnosis becomes almost impossible. Unilaterality or bilaterality are sometimes used as criteria but, although papilledema is more often bilateral and optic neuritis unilateral, one does see uni-

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lateral papilledema in the early stage and optic neuritis is occasionally seen bilaterally.

VISUAL ACUITY

The history of loss of vision may often be helpful in deciding whether the case is one of papilledema or optic neuritis. It has been stated that a history of sudden loss of visual acuity speaks for optic neuritis while gradual or little to no loss of visual acuity points to papilledema. Let us scrutinize this statement for its pitfalls. Often the word "sudden" must be evaluated carefully. For example, a patient may say that he has suddenly lost vision in an eye when he really means that he has suddenly become aware of the fact that his vision was poor in that eye. Actually, he may have had papilledema for quite a long time, with some spread of edema to the macular area and a gradual reduction in central vision.

On the other hand, the patient may say that he merely has a slight blurring of vision, that he can actually read 20/20. Such a case, at the bedside, would make one think of papilledema. Still, this picture may be that of a case of optic neuritis with a paracentral scotoma and retention of 20/20 vision. The paracentral defect may cause only a slight diminution in central visual acuity (case 1). In fact, one may see a nerve-fiber bundle defect with complete sparing of central vision (case 2). Of course, cases of these two types are not common. Case 2, demonstrating a nerve-fiber-bundle defect in optic neuritis, is probably rare. Since such cases do sometimes occur, however, the possibility of their presence must be borne in mind.

Sudden loss of vision, although classically denoting optic neuritis, can actually be the patient's description of sudden awareness of a gradual loss of vision in papilledema; and good central visual

acuity can be retained in optic neuritis with paracentral defects. From this discussion it is apparent that a study of the central fields on the tangent screen assumes paramount importance in making a differential diagnosis between papilledema and optic neuritis. This emphasis on the study of visual fields seems timely in view of Cordes's recent plea for a more extensive understanding of perimetry.⁶

VISUAL-FIELD STUDIES

The classical field picture of papilledema is that of an enlarged blind spot. In optic neuritis, however, there is a central or paracentral defect, together with some enlargement of, the blind spot and peripheral depression. Here again we encounter pitfalls, both in the examination and its evaluation.

One must remember that in early papilledema, the enlarged blind spot is surrounded by a zone of relative field defect, corresponding to the "sloping edge" of Traquair. This pericecal zone of relative defect probably corresponds to that portion of the peripapillary retina whose percipient elements, while not completely pushed aside, have been sufficiently encroached upon by the edema and pressure as to diminish their sensitivity.

When this area of relative field defect is wide enough, as in marked or rapidly spreading papilledema, it will involve, temporally, the macular area, and produce a relative central scotoma. However, to differentiate this from the central or cecentral defect of optic neuritis, we find that, in papilledema, the relative scotomatous encroachment on the central area is just the temporal portion of a general pericecal involvement, the relative scotoma reaching rather uniformly around the entire enlarged blind spot.

In optic neuritis, on the other hand, the central or paracentral defect, if connected with the cecal area, is more apt to

be connected by a comparatively narrow bridge of field defect, so that the overall picture will be that of an area shaped like a dumb bell. It may, perhaps, simulate the cecocentral defect of tobacco amblyopia. It is likely that this cecocentral communication will be lost in time. It may be that, at the start, the central or paracentral defect will show no connection with the enlarged blind spot.

In those cases of macular or paramacular involvement, in which it is difficult to tell whether the central defect is due to the spread of edema from papilledema or to an independent paracentral defect fusing with an enlarged blind spot, it has been found that when the density of the defect keeps on diminishing from the cecal area to the point of fixation papilledema is present; while, in papillitis, as the cecal area is approached, some areas of increased density again appear. If the findings are not sufficiently clear or convincing, the central fields must be followed daily. In cases of papillitis, the central defects are apt to become separated from the cecal defect within several days, the enlarged blind spot is likely to diminish in size (fig. 2 A, B, and C), and the central defect to persist as a discrete scotoma (fig. 2 B and C). In papilledema, however, the enlarged blind spot persists and even increases in size, the central defect continuing to be part of the general pericecal involvement. In other words, after a week or two, papilledema will still show a preponderance of defective field around the blind spot; while in papillitis, the greater amount of defect will persist around the fixation area.

As a rule, the connecting cecocentral portion of the scotoma of papillitis is apt to be less dense than the central one, but the relative densities of these areas may be difficult to evaluate. A careful search of the paracentral area should be made. If small enough visual angles are used,

one may find small, dense areas within larger, less dense areas. This will help to establish the diagnosis of optic neuritis. In cases of this sort, quantitative perimetry assumes great importance. For example, if the enlarged blind spot is mapped out with 10/2,000 white and no central defect is found, an examination with 2/2,000 white may bring out a central or paracentral defect, with or without a cecocentral connection. One must bear in mind that early cases only are being discussed. If a case of papilledema is several months old, some central defects may have developed. Also, one must bear in mind that there are central scotomatous defects in neoplastic lesions around the chiasma, such as in the series of cases of suprasellar meningioma recently described by Schlezinger, Alpers, and Weiss.⁷ However, in the early stage, neoplastic lesions are not likely to show papilledema, and the clinical picture is more apt to be confused with that of retinobulbar neuritis rather than with that of papillitis.

According to Traquair,⁸ one should be able to differentiate macular involvement in spreading papilledema from the central involvement of optic neuritis by the different colors of test objects. Retinal involvement from papilledema should give a defect for yellow and blue; while direct involvement of the optic nerve should cause more defect for red and green. I have been unsuccessful in duplicating all these findings in a number of cases, but have found white test objects of small sizes very useful for quantitative evaluation. Red test objects are, however, useful in determining the relative densities of nerve involvement in scotomatous areas. The patient will often give a descriptive response of the hazy red color in a less dense area and the change to a neutral gray in a denser area. A good subject can give very descriptive and reliable

responses which enable one to evaluate the relative densities of different parts of the scotoma.

In searching for scotomatous areas around the point of fixation, one must be careful about labelling an area as nonscotomatous. The two-meter screen will be found very useful for this purpose, since all scotomatous areas are so much larger in their projection on this plane and, therefore, there is less chance of overlooking a defective area. This magnification of defective area is also an advantage in examining a patient who will hesitate to speak up when the test object disappears for only a brief instant as on the smaller screens or campimeters. One should move the test object along the vertical and horizontal meridians—toward the center—rather slowly, so as to give the patient a chance to note a small area in which it disappears. Then, the intermediate meridians (that is, the 45 degree, 135 degree, and so forth) are examined in a similar fashion. I prefer to have the patient keep on saying, "I see it, I see it." In this way, there is less possibility of missing a small patch that may not seem important enough to the patient to report. If the patient just hesitates at one area, that is a lead to explore the area more carefully with weaker stimuli.

When this is over and no scotoma has been found, I like to use "rapid comparisons"—that is, placing the test object in one pericecal quadrant and changing it quickly to another; or, placing it near the point of fixation and then quickly changing it to a point 10 or 15 degrees away in the same meridian. The patient is asked if there is any marked difference in the appearance of the target in these various areas. This method will help to pick up patches of relative scotoma in which the density changes so gradually that the patient will not notice the change with

steady, slow motion. A sudden contrast between this area of relative scotoma and a normal area will make the change more apparent to the patient.

Pericentral quadrants should show up the test target equally well at points equidistant from the fixation point. If the patient says that the target is definitely brighter or clearer peripherally than at a more central point in the same meridian, further investigation should be made, for this information points to some central or paracentral defect.

In describing a scotomatous area as absolute, it is best to use at least a 10-mm., or even 20-mm., white test object on a two-meter screen. Even then, one must remember that this area is absolute for that particular visual angle and may still be only relative for a larger visual angle or with greater illumination.

The use of small white test objects for the study of the blind spot in these cases is often difficult and has its pitfalls. Test objects even as large as 2.0 mm., although normally subtending a visual angle large enough to reach even beyond the 30-degree arc on the two-meter screen, may not reach this far in cases of papilledema or optic neuritis because of the peripheral constriction that often accompanies these conditions. In such cases, the blind spot may fall outside the peripheral field for that visual angle. This same principle holds true for the paracentral area where the isopters for small angles are close to the point of fixation. In other words, in examining the blind spot or the paracentral area, one must be certain that the area investigated falls within the peripheral limits of the field subtended by the particular visual angle used. A simple method for ascertaining this information is to make sure that the patient can see the test object on the screen somewhere temporally to the blind spot. If the field for $2/2,000$

white should extend to the 15-degree meridian, thus making this visual angle unsuitable for a study of the blind spot, it is still suitable for evaluation of the pericentral area.

The 1-mm. white test object at two meters must be used with great caution even when exploring the field within the

should wear their corrections. Care should be taken when the patient is wearing bifocals with high reading segments. In such cases, it is best to use a trial frame and trial-case lens with the distance correction only.

CASE REPORTS

Case 1. S. W., a white man, aged 54

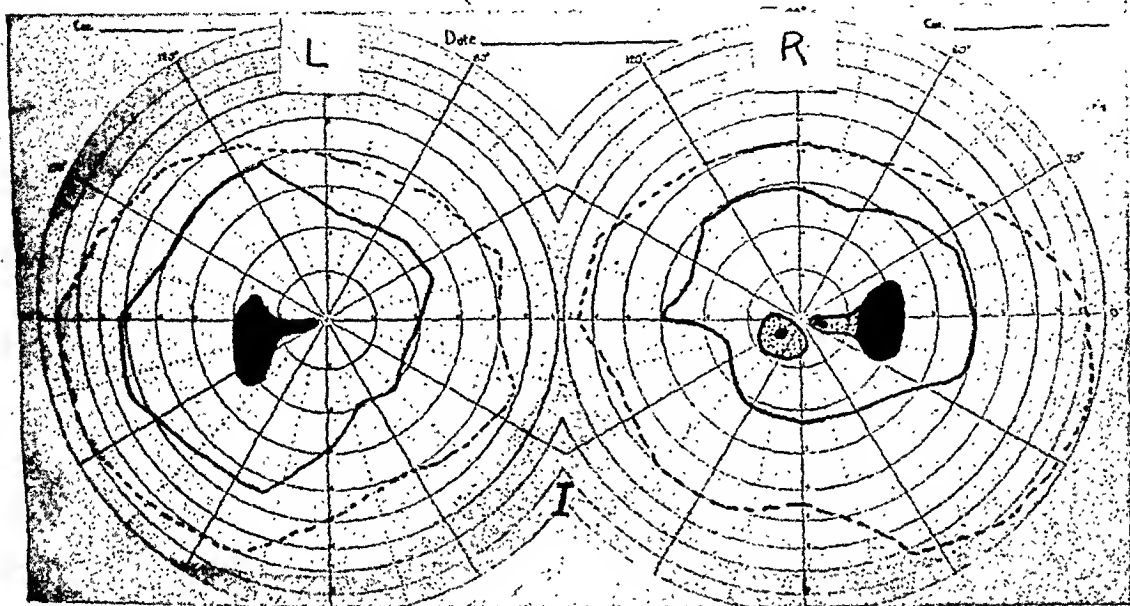


Fig. 1 (Chamlin). Case 1. Papillitis with paracentral-field defects. Peripheral-field studies on March 24, 1946, for 5/330 white and 1/330 white. Central-field studies for 10/2,000 white show enlarged blind spots with extension toward, but not quite reaching, point of fixation, and an independent, relative paracentral scotoma in the right eye, with a dense nucleus. White line within the enlarged blind spot denotes the normal blind spot.

5-degree arc. With such small test objects, the carrier becomes very important, and one must be careful to ascertain if the patient is really aware of the white test object rather than of the carrier. I have found the spherical test objects most useful in all my work.

A word or two about wearing of corrective lenses during central field examinations on the two-meter screen seems in order. Young patients with small hyperopic corrections, (+1D. or less) are better tested without their glasses. If the patient's age is more than 35 or 40 years, it is preferable for them to wear even small plus corrections. All myopic patients

years, was admitted to Montefiore Hospital March 21, 1946. A brain tumor was suspected. The patient stated that the vision in his right eye had been a little blurred for the past few days.

Both fundi showed swollen discs with hemorrhages, exudates, and engorged veins. Vision in the right eye was 15/40; in the left eye, 15/20. Field studies done on March 24th revealed a generalized peripheral depression for 5/330 white and an even greater depression with local indentation for 1/330 white. These conditions were more marked in the right eye in which central vision was most affected. Central-field studies were made with

10/2,000 white. Both blind spots were enlarged to almost five times their normal size, with extension of the scotomatous areas toward the point of fixation. There was an independent, relative paracentral scotoma with a dense nucleus in the right eye. In 10 days, the blind spots diminished to less than twice their normal size. In one month, the blind spots were almost

Visual acuity was 15/13 in each eye and remained so throughout a month of observation. The left fundus was normal. The right fundus showed a swollen disc, with hemorrhages, exudates, and engorged veins. Field studies revealed normal findings in the left eye. The right eye showed a localized depression in the lower peripheral field for 4/250 white. The cen-

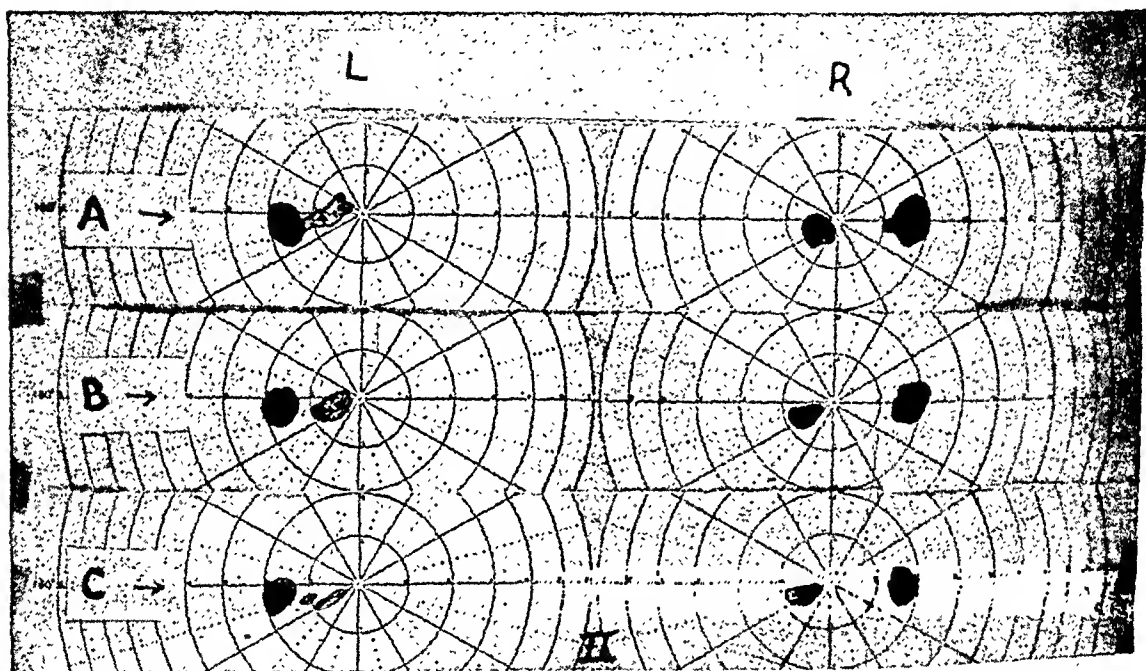


Fig. 2 (Chamlin). Follow-up of central-field studies on Case 1. Done with 10/2,000 white. A, April 3, 1946; B, April 15, 1946; C, April 24, 1946. Successive studies show diminution in the size of the blind spots, with persistence of paracentral defects.

normal, but the paracentral defects persisted and were still present in August, 1946.

This case illustrates papillitis with little loss of central vision in one eye and practically no loss in the other. Until the central studies were made, the funduscopic picture and retention of fair central vision led one to believe that the condition was one of papilledema.

Case 2. G. T., a white man, aged 52 years, was seen on May 11, 1946, with a history of a "film" over his right eye for the past week.

tral field for 2.5/1,000 white showed an enlarged blind spot with a relative scotoma extending down from it and spreading and arching around the point of fixation as a Bjerrum scotoma or nerve-fiber-bundle defect.

One month after the original field studies were made, the scotoma showed signs of clearing, but vision remained 15/13.

This case illustrates papillitis with a nerve-fiber-bundle defect and preservation of normal central vision as measured on the Snellen chart. Central field studies gave the necessary proof that this was a case of papillitis and not papilledema.

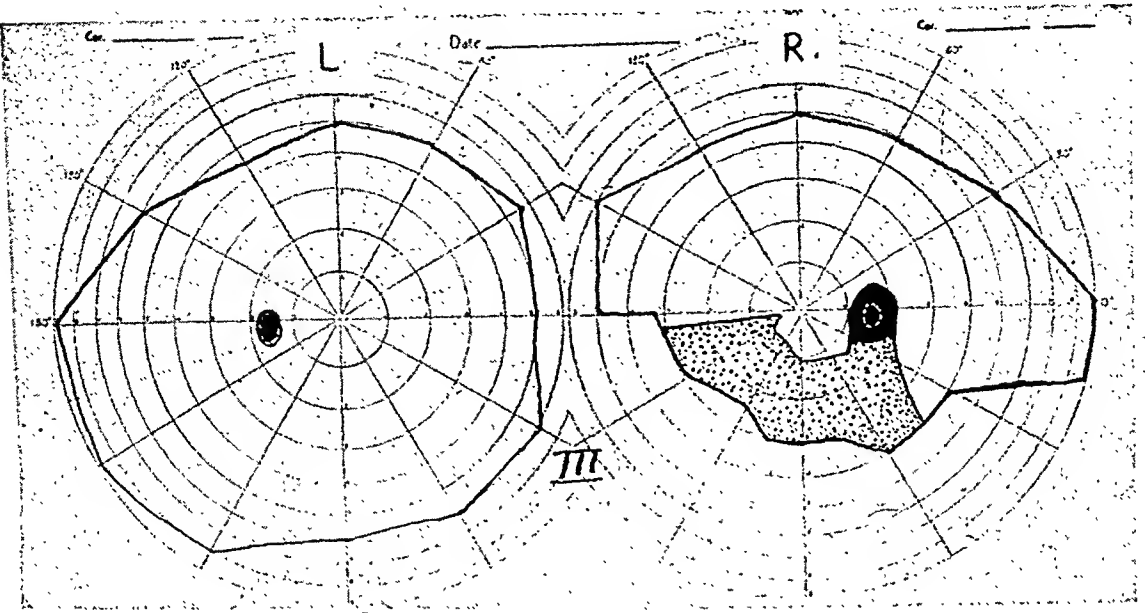


Fig. 3 (Chamlin). Case 2. Papillitis with nerve-fiber-bundle defect. Peripheral field for 4/250 white shows local depression below, fusing with the relative nerve-fiber-bundle defect coming down from the enlarged blind spot. The central field was mapped out with 2.5/1,000 white.

SUMMARY

The early stages of papilledema and papillitis (optic neuritis) may produce a confusing picture. This is illustrated by the presentation of typical cases. The history, clinical examination, ophthalmoscopic appearance, and visual acuity may

not be enough for differentiation. The study of the central fields of vision is of paramount importance in such cases. However, central field studies present many problems, a few of which are evaluated in this article.

1840 Grand Concourse (57).

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WHICH SQUINTS RESPOND BEST TO ORTHOPTIC TREATMENT*

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The determination of the squints responding best to orthoptic training is one of the most important problems confronting ophthalmologists and orthoptic technicians today. We feel compelled, therefore, to look back on some of our work and search the records for any findings of apparent significance. Every fact which may assist us in making a good prognosis should be brought to attention at this time for several reasons:

1. A correct diagnosis and good prognosis will determine whether the squint is amenable to active orthoptic treatment.
2. Accurate diagnosis makes it easier for the ophthalmologist to place the patient in the proper category and thus put the proper emphasis on the type of treatment to be carried out by the technician.
3. A correct prognosis will make it possible to judge the length of time necessary for treatment, which is an item to be considered when certified orthoptic technicians are so scarce and the demands on their time so great.
4. When the patient can be placed in the proper classification, after a correct diagnosis, the ophthalmologist is better able to determine if and when surgery is necessary. It also aids him in the choice of surgical procedure.

First of all then, let us consider some of the types of squint. It is apparently agreed upon by ophthalmologists and technicians alike that purely accommodative squints offer the best prognosis. The squints which have a large accommodative factor are responsive to orthoptic treatment and refractive correction if the angle of deviation is not over 30 to 50

diopters, depending upon the accommodative element. Needless to say, the state of fusion must be good.

Squints with a large convergence-insufficiency factor are almost certain to give a good prognosis with a few months of treatment. However, squints with a pure or even a primary divergence-excess factor must be turned back to the surgeon for a truly complete cure. It so happens that most squints show a combination of the two factors, that of convergence insufficiency being the most common.

We have found that the few convergent squints with a larger angle of deviation for distance than for near are often more difficult to train. However, out of seven such cases in the past three years, two have been discharged as cured. We do not believe that any nonaccommodative convergent squints over 25 diopters are very amenable to cure by orthoptic training alone. Such a course of treatment is only recommended by the doctor when the patient is strongly opposed to surgery and does not consider the time element of treatment important.

Paralytic squints seldom fall into the category of purely orthoptic cases. Some cases of recent paralysis are referred on occasion, but, as a rule, the doctors do not consider even a case of paresis to be receptive to treatment alone. It is certainly true that most cases with a paresis of a vertical muscle must eventually be turned back to the surgeon, as nothing is more difficult for a patient to overcome than the uneven images of a large or highly variable hypertropia. If the vertical deviation is within 6 or 8 diopters, the incorporation of prisms in the glasses is often adequate until some compensation has been acquired in everyday seeing.

* Read at the meeting of the American Association of Orthoptic Technicians, Chicago, October 14, 1946.

In regard to amblyopic squints, only those patients with 20/50 vision, or better, in the poor eye are considered for active treatment. There does not appear to be any contraindication to a good result when visual acuity has been improved or central fixation has been restored. Preferably, not more than one or two lines difference in visual acuity should be found. The age of the patient is, however, important in considering the improvement of vision or the establishment of central fixation by occlusion or flashing. When the patient has reached teen age, it is difficult to carry through a strenuous procedure such as complete occlusion and monocular homework.

The prognosis of the anisometropic squints is rather difficult to predict. If the anisometropia is not more than 3 diopters and an alternate fixation is established in a short period of time by active treatment and occlusion, it appears to us that there is a possibility of cure. The attempt, therefore, may be worth while. Usually occlusion and treatment must be quite prolonged, even after alternate fixation has been obtained. Our experience with this type of squint has not been adequate to enable us to make any definite statements or positive conclusions. Since it has been noted that a number of cases of anisometropia with suppression or even amblyopia have shown no deviation at any time, it might be that surgery would prove most beneficial.

Most patients with a dissociated vertical divergence appear to have a general nervous instability that in itself is a definite handicap. These cases are said to be neurologic in origin, which makes us feel that the improvement of the patient's general physical condition will, perhaps, be more beneficial than a strenuous orthoptic work-up or possible surgical intervention.

It will probably be inferred from this

discussion of types of squint that there is already some selection of cases at the Milwaukee Ophthalmic Institute. This is true in that a trial series of treatments, consisting of about eight visits, usually weeds out those cases considered uncooperative, not amenable orthoptically, or perhaps not ready for active treatment at the time. Nevertheless, we are only too cognizant of the fact that a greater and better selection of cases is necessary; especially is this so when the element of the time involved in some treatments must be considered. We are only too aware of the fact that we are still groping for added information on many problems.

In approximately three years of work, 255 unselected cases have been studied. Only 146 of these have had any active treatment of any kind. Of this number, 16 have now been discharged as cured, and 53 as definitely improved. Seven patients were discharged by us when several series of treatments failed to give the desired effect, and a score or so of patients have dropped out for various reasons of their own. The remaining number are still on treatment, although some have been given short vacations by the doctor. Frequently, a leave of absence will help to determine a patient's ability to hold what he has gained, and many times it aids one in making a prognosis. Eleven of the 44 cured or improved cases had surgery, five preorthoptically. The length of treatment varied from $2\frac{1}{2}$ months to as long as $2\frac{1}{2}$ years in a few cases. The age of the patients ranged from 3 to 45 years. During the last three years, the lack of personnel has forced the doctors to suggest that we devote the greater part of our time to children, in the belief that by doing this we could accomplish the greatest amount of good. Most of the children have been 3 to 8 years of age.

Our statistics on the findings and results in the treatment of a few types of

squint may be interesting, but you will readily concede that we have gained little of definite value in making a prognosis. We have all ascribed too many failures to certain abnormal physical conditions and too many successes to normal physical reactions. We may also attribute too much importance to the classifications of squint cases and to the statistical findings of such groups. There are certain handicaps to a successful result, we must admit, and these have been stated by too many ophthalmologists and technicians to bear repetition. When we try to sift out certain facts of apparent relevance, however, we realize that there are not sufficient data of statistical importance. Our leads do not *prove* anything; they do not even show much definite correlation. We can only reiterate the claims of others when we state that cases of rather late onset and short duration give the greatest hope of cure without resorting to surgery. As previously stated, our cases of accommodative squints are usually treated without any orthoptic exercises; squints with a large factor of convergence insufficiency can almost certainly be cured with some supervised work and home training; those with a major divergence-excess element require surgery in most instances—that is just about the extent of our findings.

In the final analysis, it is apparently not so much the type of squint which is significant, as it is the type of squinter. One of the most important factors to be considered in the individual case is the fusion status of the patient at the beginning of treatment. Those patients with muscle pareses, mixed correspondence, marked anisometropia, pure divergence excess, or dissociated vertical divergence are all handicapped, but they certainly are not hopeless cases. When only a glimmering of diplopia or true correspondence, a constant alternate suppression, or a persistent, firmly fixed, abnor-

mal correspondence are present, there is reason enough to question the advisability of active treatment. Certainly a trial period of 2 or 3 months with no result in the elicitation of simultaneous macular perception or fusion is sufficient to discourage the most optimistic technician.

On the other hand, patients with quick response to fusion and even a feeble attempt at voluntary control are reasons for encouragement, as they are rare indeed in our Clinic. It has been our experience that a good or poor fusion faculty can only be determined by a short trial period, since there are no positive points in the history of the case to denote this possibility. When onset of the squint is at 3 to 6 years of age with some intermittent appreciation of single binocular vision, we are optimistic. However, a history of squint from birth does not necessarily indicate a poor prognosis. This is especially true if, at some time, the squint was an intermittent one, or if the patient is young (yet coöperative), because the duration of squint is then short.

The exceptions in the cases of squints with poor fusion dating from birth, are too many to enable us to make any positive statements or predictions. There are also many cases with histories of late onset and short duration which prove bitterly disappointing. We do not know how much we can depend upon any history, since so many prove unreliable. Few parents know what caused the squint, whether it is constant or occasional, or whether the onset was sudden or gradual. The squint is usually noted gradually, and, when we make the provisional diagnosis of constant manifest strabismus, most parents tell us the squint is only an occasional one, although it is sufficiently great to be obvious even to the lay person.

In spite of the fact that much is said and written about the poor prognosis of cases with abnormal retinal correspond-

ence, we do not find that most cases with a firmly established anomalous correspondence are much more difficult to treat than those with a persistent marked alternate suppression. Most of our cases show a marked suppression at the start making it necessary for us to treat them for a month sometimes, before coming to a definite decision concerning the prognosis.

Obviously we never diagnose the correspondence until some kind of actual binocular vision has been established; many cases of rapid alternate suppression simulate an abnormal sensorial correspondence, and the patient's answers, even in regard to the crossing of images, are unreliable. The cases of constant monocular esotropia with a rigid and moderate deviation are most likely to show a firmly fixed abnormal correspondence. Most of these cases, as well as most cases of marked alternate suppression, do occur in squints dating from infancy; that is, before three years of age. In fact, 71 out of 92 firmly fixed abnormal correspondence cases, which were studied, were apparently squints since infancy. It might be well to mention here that most of the cases dating from infancy also have a history of an inherited tendency. Out of the 255 cases studied, 109 cases had an hereditary deficiency. Out of the 109 cases giving this history, 86 cases dated from infancy. If the truth were known, inherited fusion deficiency would be a factor in the etiology of many more cases.

Second in importance only to fusion as a prerequisite in successful squint training is the attitude of the patient—the personal desire for cure. At times we feel

this to be the most important consideration in the case, which challenges us all the more. Our experience has taught us that seldom does poor fusion sense, or centers, prove too much of a handicap for the patient who is eagerly intent on improvement—not forgetting, for our part, that at times an apparently insurmountable handicap may discourage the most eager patient. However, we fully realize that, as in any teaching process, the proper stimulus will usually elicit both attention and interest. Our constant questions must be so worded as not to divulge what we may expect or wish as an answer; yet they must help the patient to scan the targets for details that will suggest enough information to elicit further information. In this way the imagination of the patient is stimulated. By constant questioning only are we able to assure sustained attention.

When we survey orthoptics in all its aspects, we must acknowledge that our success or failure depends upon the patient as an individual—as a person to be taught rather than treated. Certainly the patient who is physically and emotionally ready for teaching has the best chance for success. We, as technicians or teachers, must assess the needs of the individual. We must judge the advisability of actively stimulating the patient with a phlegmatic divergent squint by routing his success. We must consider the importance of passively stimulating by subtle suggestions of success a patient with a hyperkinetic convergent squint. It is this personal equation which truly spells success or failure.

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DISCUSSION

DR. FRANK D. COSTENBADER (Washington, D.C.): It is a pleasure to discuss Miss Roth's paper. Much has been

written and said on the subject of "Orthoptics" by those who, unfortunately, are not well enough qualified to be help-

ful to us. However, if *we* can correctly state that certain types of squint are helped by orthoptic procedure, and other types are not, we are being helpful. Miss Roth has offered certain thoughts, and, in the main, I agree with them.

In my experience, three groups of cases respond well to orthoptic treatment. The first, convergence insufficiency, while not a squint, is a dysfunction of ocular motility, and rightly should be considered here. Convergence insufficiency is common and makes up the bulk of work in many orthoptic clinics. In my own practice, limited to children, the number is smaller, but these respond quite well to the binocular stimulation of accommodation, which is the chief method of stimulating convergence. We use so-called pencil exercises with many variations, prism exercises, the stereoscope with "base-out" slides, the metronoscope, and the major amblyoscope.

The second group of squints to respond well are the accommodative convergent ones, and, of these, the "typical" respond better than the "atypical." By "typical" I mean those whose esotropia varies directly with the diopters of accommodation being exercised. By "atypical" I mean those squints having a small refractive error, but an excessive esotropia when even moderately accommodating. The dissociation of accommodation and convergence in the typical cases has been most helpful.

By teaching blurred vision with straight eyes, gradual clearing of vision with straight eyes, and the consciousness of diplopia when convergence occurs, hyperopes of 4 diopters or less may learn to stay straight without glasses, and still see adequately. I should guess that 50 percent of typical accommodative esotropes may learn to live happily without glasses for constant wear.

The third and final group benefiting greatly from orthoptic training are the cases of moderate divergence excess. I have the feeling that over one half of the cases having a divergence of 20 diopters or less can be taught to maintain straight eyes at all times except when ill or extremely fatigued. Divergence of more than 20 diopters can rarely be treated by orthoptics alone, but must have one or both lateral rectus muscles recessed, as well.

Orthoptic procedure is most helpful as an adjunct to surgery in obtaining a final cure in the more mechanical types of strabismus. I personally do not emphasize presurgical, but do stress postsurgical, orthoptic training.

May I point out, with Miss Roth, that any degree of success in treating any type of squint requires not only an interested, intelligent patient, but also interested and intelligent parents? Lack of interest will defeat the most sensible and persistent training program.

DIVERGENCE EXCESS: AN ANOMALY OF THE EXTRAPYRAMIDAL SYSTEM*

ELECTRA HEALY

Chicago, Illinois

A review of the literature concerning the condition known as divergence excess revealed the fact that not only are we progressing in our knowledge of this particular condition, but that many of the facts are, and will be, applicable to other types of ocular muscle imbalance as well.

Since there seems to be some variance in definitions given by the different writers on this subject, I should like to make my own understanding of divergence excess clear by quoting from a paper by Berens, Hardy, and Stark, which was read before the American Ophthalmological Society in 1929:

"We characterize as divergence excess that ocular muscle imbalance exhibiting an exophoria more marked when the gaze is directed into distance than when it is adjusted for near vision, combined with normal prism convergence and near point of convergence and an excessive ability to overcome the diplopia caused by prisms placed base in before the eyes. The lateral movements of each eye should be normal and comitant."

The incidence of divergence excess in our office for the past 5-year period—the length of time our orthoptic department has been opened—was approximately 0.8 percent of all eye conditions which required the services of an ophthalmologist, and two percent of all cases which were referred to the orthoptic department. The age of the patient at the time of the first visit varied from 3 to 62 years.

All patients were examined under cycloplegia, with the exception of the old-

est patient. Although cases of hypermetropia predominated in this group, other types of refractive error, including compound and mixed astigmatism, and both hyperopia and myopia, were found. There was also one case of aniseikonia. Therefore, no significant correlation was found to exist between divergence excess and ametropia of any specific type. This is almost in complete accord with the data given by Berens, Hardy, and Stark. I feel that this is of particular interest, because of the lapse of time between the two findings and the different locations in which the studies were made.

One of the oldest theories to account for divergence excess, a theory which I believe I can safely say has been abandoned, was that of "weak muscles." Now this interpretation of weak muscles is not to be confused with the one of poor muscular tone caused by lack of exercise or some constitutional condition such as anemia or ill health, all of which may well contribute to weakened convergence power.

More recently, the theory that divergence is not a negative factor of convergence has been suggested by the possibility of an actual divergence center in the brain. The supposition that overstimulation of such a center is the cause of divergence excess remains unproved, however, to those who have worked with this type of squint. Bielschowsky's opinion that divergence excess is due to an anomalous position of rest, considering the anatomic arrangement of fasciae and ligaments of prime importance, is also unconvincing in the light of what may be obtained by orthoptic treatment.

Just what may be gained by orthoptic

* Read at the meeting of the American Association of Orthoptic Technicians, Chicago, October 14, 1946.

training? Through prolonged, conscientious, and ever-increasing effort in orthoptic training, much may be accomplished. All cases of divergence excess, even the very low percentage of cases requiring surgery, need the additional stimulus that orthoptics can give, more than they need any other one aid in correction. Why is this so? Because orthoptics teach correct habits and skills. If anomalous correspondence is present, it may be corrected by reeducation through fusion stimulation, and by the development of a large amplitude of fusion. The proper relationship between accommodation and convergence may be established and suppression overcome, all because these conditions are established by the cerebral cortex, the center of learning.

Does all of this effect a cure? That depends entirely upon the definition of a "cure." I like to think of a cure as being absolute and habitual at all times and under all circumstances; if that is meant, then the answer is "no." Although these patients may be taught to accomplish the highest standard of "mechanical cure" and transfer it to their "casual seeing," there are still times when deviation is manifest, without the patient's awareness of it, for only rarely is spontaneous cross diplopia noticed by the patient.

This inability, on the patient's part, to know when the eye is divergent—even in view of the satisfactory experience that binocular single vision gives—may be accounted for by the complete absence of any conscious sensation of the position of the eyeball, or even further by the apparent absence of a definite proprioceptive mechanism in the ocular muscles. If this were not so, nerve impulses reaching the central nervous system would give infor-

mation concerning tension of the muscles and relative position of the eye. In sleep, when the cerebral cortex is inhibited, the eyes assume a divergent and upward rotation; but upon awakening, the "fixation reflex" and "attention mechanism," both prompted by the higher level of cortical control, bring them into parallelism. However, relaxation of attention or day-dreaming affords opportunity for the unnoticed divergence of the eyes.

Normally, during this period of relaxation, the eyes are held in correct position by synergy or postural tonus. The innervations responsible for these correct positions of the eyeball may resemble those of other muscle systems of the body in being of two types. One consists of conscious perception and volitional direction, as served by the pyramidal tract from the motor cortex; the other, which does not require the attention of consciousness and which effects involuntary adjustment, is subserved by the extrapyramidal system. An anomaly lying somewhere in this little known system accounts for the failure that occurs when the "fixation reflex" or "attention mechanism" is not in complete control.

CONCLUSION

1. Divergence excess occurs in one to two percent of all cases in the private practice of ophthalmology.

2. Divergence excess is not correlated with refraction.

3. Orthoptic treatment is the most satisfactory correction method employed today because it corrects, to a great extent, the neurologic factor.

4. Divergence excess is an anomaly of the extrapyramidal system, and research in this field is urgently needed.

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NOTES, CASES, INSTRUMENTS.

GLAUCOMA TREATMENT*

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Since glaucoma is the most frequent cause of loss of sight, its treatment is one of the outstanding problems of ophthalmology and its prevention can be regarded as a national service. Research into the etiology of this disease, study of statistics based on large numbers of cases, rationalization of operative treatment, and analysis of drug therapy are the materials from which ophthalmologists forge the weapons for combatting this disease.

The ophthalmic clinic of Budapest University under the guidance of its late director, Prof. Emil Grosz, undertook extensive work along these lines, and it was the privilege of this writer to take part in the work. The experience gathered from the investigation of several hundred cases during this work and from operations on many patients at the ophthalmic department of the Jewish hospital at Budapest has led not only to the writing of this paper, but also to the observation which is this paper's most noteworthy contribution to the study of glaucoma; namely, that spontaneous venous pulsation signifies a more favorable retinal circulation and that retinal nutrition is less impaired in those patients having spontaneous venous pulsation than in those in whom it is lacking.

Professor Grosz in his last two lectures on glaucoma delivered in 1939 at Nancy and in London (Hunterian lecture) summed up the experience gained from performing 4,927 operations. He outlined instances in which surgery is indicated as follows:

1. Iridectomy in cases of inflammatory glaucoma.

2. Iridectomy in cases of acute inflammatory glaucoma which react to pilocarpine-lowering of the tension.

3. Posterior sclerotomy followed by cyclodialysis and subsequent iridectomy in cases of acute glaucoma which do not react to pilocarpine.

4. A trephining operation as the first treatment, followed by cyclodialysis, for chronic inflammatory glaucoma.

5. Lagrange's operation followed by cyclodialysis in cases of glaucoma simplex.

Grosz believed that cyclodialysis could be regarded as less dangerous than trephination, but he also recognized that, in trephination, the immediate results, as well as the later effects, are more favorable. The advantage of cyclodialysis, however, is that it can be repeated several times. Insufficient knowledge as to the processes which produce the effects of these operations was, in Grosz's opinion, the contributing factor to the surgeon's inability to make a rational choice.

Experience with many cases in Grosz's clinic demonstrated the fact that posterior sclerotomy in cases which did not respond to pilocarpine during the acute attack resulted in quite transitory decrease of tension; so there was little sense in applying it. Likewise, cyclodialysis contributed little to the lowering of tension during an acute attack. (Goldman says that it is effective only in cases in which the eyes possess deep chambers.)

My experience, based on 346 operations, shows that iridectomy for prodromal and acute glaucoma improved by pilocarpine gave excellent results in 188 cases. In 26 cases which did not respond to pilocarpine during the acute attack and in which the possibility of subsequent

* From the Department of Ophthalmology of the Hospital of the Jewish Community at Budapest.

hemorrhage or expulsive hemorrhage excluded iridectomy, I applied Lindner's posterior trephination as a preparatory step and followed this in two or three days with iridectomy. Soon after Lindner's trephination, the tension decreased; the chamber deepened; and the opacity of the aqueous humor, sometimes rich in proteins, disappeared in every case within a few days. By itself, Lindner's trephination is insufficient. In six cases of absolute glaucoma in which posterior sclera trephination was the only treatment, the eye hardened again within six to eight days.

In 53 cases, I applied Heines and later von Sallmann's cyclodialysis. The results were unsatisfactory. Since I had had ample opportunity in Grosz's clinic to follow cases in which the eyes had hardened again after repeated cyclodialysis, I resolved to treat every case of chronic inflammatory and simple glaucoma by Elliot's trephining operation and, to date, I have done so in 57 cases.

The mechanism of the surgical procedures just described have been elucidated by the investigations of Fr. Kiss,¹ professor of anatomy at Budapest University. According to his views, the circulatory system of the ciliary body has been divided into two contradistinctive parts: (1) grossly entwined vessels serving filtration (the ciliary process); (2) thin-walled vessels serving absorption (the ciliary plexus). The beneficial effect of cyclodialysis is due to the liberation of the suprachoroidal space whereby the finely interwoven system of the ciliary plexus becomes free, its circulation accelerates, and absorption increases.

Actual observation confirms that, after cyclodialysis, hyphemia disappears with astonishing rapidity within the chamber, while after iridectomy hyphemia lasts for several days. Kiss's explanation is, there-

fore, plausible enough and a contradiction to other theories (Heine, Elschnig). It is a fact, however, that cyclodialysis is ineffective in 50 percent of cases (Grosz). Obviously, this is so because the formation of synechias obliterate the ciliary plexus, its circulation is impeded and with it, absorption.

Kiss's theory explains that the chamber deepened by Lindner's trephination gives free access to the ciliary body and, thereby, improves conditions for iridectomy. The lasting decrease of tension in Elliot's trephining operation has to be ascribed to filtration and partly to the developing of the vessels (Sondermann) which connect the episcleral veins (anterior ciliary vein) and the ciliary plexus, thereby facilitating drainage.

Since there are cases which, despite iridectomy, repeated cyclodialysis, and Elliot's trephining operation, become hard again and do not react to the 1- to 2-percent pilocarpine solution administered in the conventional manner, I have established a new treatment.² Satisfactory results have been achieved in such cases by administering a combination of 1:1,000 adrenalin, $\frac{1}{2}$ - to 1-percent pilocarpine and, once or twice weekly, 1-percent adrenalin. I have treated numerous cases which remained hard despite operation and the usual pilocarpine treatment and which became permanently soft after this therapy.

During 1944 and 1945, when many glaucoma patients were confined to the ghetto at Budapest and there was no adequate medical treatment nor pilocarpine available, valuable observations could be made.

It was from the detailed examination of these patients and from comparing their fundi with fundi which had been altered by such conditions as high myopia, atrophy of the optic nerve, and so forth,

that we came to the impelling conclusion which is the salient feature of this communication.

Spontaneous venous pulsation signifies a more favorable retinal circulation and where it is present, retinal nutrition is less impaired. Under such circumstances, the increase of blood pressure according to Lauber-Sobansky as a means of general treatment of chronic glaucoma, concomitant with a decrease of venous pressure, may be justified.

SUMMARY

Iridectomy is the operation of choice in cases of prodromal and acute glaucoma responding to pilocarpine by decrease of tension.

Acute glaucoma not amenable to pilocarpine should be treated by Lindner's trephination followed by iridectomy after two or three days.

Elliot's trephining operation is indicated in cases of inflammatory chronic and simple glaucoma.

After-treatment of suitable cases is favorably conducted by the administration of a combination of pilocarpine and adrenalin.

For general treatment, decrease of venous pressure is suitable.

Whatever operative procedure is executed, after-treatment has to be conscientiously followed.

V., Személynök-u. 9-11. 1/23.

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¹ Kiss, Fr. *Ophthalmologica*, 1943, v. 106, p. 225.

² Weinstein. P. *Ophthalmologica*, 1942, v. 104, p. 166. Etiology and therapy of glaucoma, Budapest, 1943. (Monograph in Hungarian).

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

BROOKLYN OPHTHALMOLOGICAL SOCIETY

October 24, 1946

PSEUDOTUMORS OF THE MACULA

DR. RALPH I. LLOYD presented a paper on this subject in which he considered the differential diagnosis of macular disease including consideration of histologic reports as well as clinical history. The vascular degenerative and neoplastic processes were given detailed analysis, their obvious distinctions and often confusing similarities were emphasized. The lecture was supplemented by excellent Kodachrome slides.

OBSERVATIONS ON TRACHOMA WITH SPECIAL REFERENCE TO A "CARRIER STATE"

DR. MARTIN BODIAN spoke on a study of a group of natives working at an American Army Base in Fiji which showed that 22 percent were found to have active trachoma. Of these, 68 percent showed Prowazek-Halberstaedter inclusion bodies on conjunctival smears. Of those natives who were free of trachoma, 34 percent had conjunctival inclusion bodies. These inclusion bodies were found to be identical in every respect to those found among the trachomatous patients. It is felt that this is suggestive of a carrier state in trachoma. American troops living in this endemic trachoma area for long periods of time under hygienic conditions showed no clinical or laboratory evidence of the disease.

George A. Graham,
Associate Secretary-Treasurer.

SOCIEDAD OFTALMOLOGICA DE MADRID

June 14, 1946

INTRAOCULAR FOREIGN BODY UNKNOWN TO PATIENT

DR. CARRERAS presented a case in which the patient not only did not know that he had a foreign body in his eye but denied ever having received an injury to the eye which could have made the presence of a foreign body possible.

The patient had a history of slowly losing the sight of his right eye for a couple of years. He complained that now he had pain in the right eye and some photophobia in his good left eye, which latter fact disturbed him greatly. Examination showed an enormously deformed globe.

The media were normally transparent, but in the cornea could be seen, by means of the slitlamp and corneal microscope, a very thin, peripheral linear cicatrix which comprised the whole thickness of this membrane. The ophthalmoscope showed atrophy of the papilla and a glaucomatous excavation. In the lower-outer section, near the equatorial region of the eye-ground, could be seen a large atrophic plaque of chorioretinitis, of irregular outline and irregularly pigmented. Tension was 50 mm. Hg, and the diagnosis was chronic simple glaucoma, secondary to an intraocular foreign body, in spite of the negative history.

As the patient was anxious to conserve the eye, a cyclodiathermy puncture according to Vogt was attempted. Although the tension fell to 20 mm. Hg, there appeared on the fourth day, in addition to pain, a hyphemia which filled the whole anterior chamber and which showed no

tendency to resorption. In view of this, the eye was enucleated. On examining the enucleated globe, a metallic particle was found imbedded in the choroid, thus confirming the clinical diagnosis.

The rarity of this case is found principally in these two points: (1) The patient was completely unaware of the initial trauma. (2) Secondary glaucoma developed without siderosis bulbi.

Unawareness of the injury which caused the penetration of a foreign body can be satisfactorily explained, if we grant that it might have happened in infancy or that a sterile particle from a work tool penetrated the eye with great velocity causing only slight pain and slight redness of no importance.

The manifestation of a foreign body in the form of glaucoma without siderosis is something of great rarity in ophthalmic literature. The pathogenesis raises many difficulties. We may say it is a case of glaucoma through retention or through deficiency of drainage due to the obstruction of the trabecular tissues of the pectinate ligament by the oxidation products of the iron.

Discussion. Dr. Marin Amat congratulated Dr. Carreras on the study of the chemical analysis of the ocular contents of the patient and suggested that the histopathologic analysis of the retina would have been as interesting as it was in a case of his own which he presented, in 1934, to the Ophthalmological Society of France. In that case, with a dye of ammoniated silver, he showed in the retina the presence of many microglial cells, microphotos of which were published in the *Bulletin* of the Society and in the *Annales D'Oculistique* of Paris with the original work.

Dr. Mario-Esteban. The case presented by Dr. Carreras is very instructive not only because of the long presence of an intraocular foreign body, unknown to the

patient, but principally because of the histopathologic reactions and the biochemical reactions which such a tiny particle could arouse to produce glaucoma.

Dr. Carreras (in closing), replied to Dr. Martin Amat. No anatomic examination of the eye was made because it would not have taught us anything, which is what one seeks in the study of the things gained by surgery. We all know that our ignorance of the pathogenesis of primary glaucoma is due, above all, to the difficulty of obtaining glaucomatous eyes in the first stages of the disease, in order to study them from the viewpoint of the first changes. Old glaucomatous eyes show us lesions which are the result of the disease and not the cause of it. This is a case of absolute glaucoma, of at least two years' duration, and a study of the changes found in this eye would have taught us nothing new.

In his reply to Dr. Mario-Esteban Dr. Carreras thanked him for participating in the discussion of the case presented, and said that his remarks were always interesting and carried the value of his large and rich experience. Dr. Carreras said that during our war of liberation there were many foreign intraocular bodies unknown to those who had them. He could attest to that since he was chief of the ophthalmological service of the six hospitals in Cadiz. However, what is frequent and natural in war where in the excitement of combat a soldier may be unaware of the trauma caused by a projectile is quite a different matter in times of peace where one generally takes note of the slightest injuries save in exceptional instances as seems to be the case in our patient.

A PARTICLE OF IRON IN THE VITREOUS REMOVED BY THE SCLERAL ROUTE

DR. MARIN AMAT AND DR. GARCIA MANSILLA presented a patient from

whose eye a foreign body was extracted within 18 hours after its penetration. The following technique was used.

Retrobulbar anesthesia was performed with 2 cc. of 4-percent novocain to which a drop of adrenalin (1:1,000) had been added. An injection of 2 cc. of 2-percent novocain with two drops of adrenalin (1:1,000) was made in the lower-outer quadrant of Tenon's capsule beneath the external rectus and the inferior rectus muscles. Superficial anesthesia was obtained with 4-percent cocaine.

1. A nonmagnetic eye speculum was placed and an incision was made in the conjunctiva and Tenon's capsule in the lower-outer quadrant along the 4:30-o'clock meridian, exposing a large section of the sclera.

2. A silk thread was placed under the external and the inferior rectus, and these muscles were drawn upward and inward so as to expose the sclera.

3. The large cone of the giant electromagnet was applied to the sclera in order to attract the foreign body.

4. Diathermy coagulation of the anteroposterior surface of the sclera was done in the same meridian to avoid hemorrhage of the choroid.

5. Three interrupted and equidistant sutures were placed between the lips of the conjunctival wound in order to tie them immediately after extraction of the foreign body so as to avoid loss of vitreous.

6. An anteroposterior incision of some 5 mm. was made with a Graefe knife along the line of coagulation in the sclera embracing this membrane and the choroid. This was done without the least hemorrhage.

7. The long, thin part of the electromagnet was introduced into the vitreous, and by using the proper current and leaving it in for several moments, the foreign body was extracted. This proved to be a

piece of steel of the form shown in the X-ray film. There was no loss of vitreous.

8. The sutures, already prepared in the bulbar conjunctiva, were tied. At the end of the operation a drop of sterile 1-percent atropine and 4-percent mercurochrome were instilled in the eye and a monocular bandage was applied.

As a preventive measure, the usual dose of cibazol, internally, injections of cephone, and later calcium chloride, orally, were prescribed. The postoperative course was uneventful. There were no hemorrhages and only a very slight oozing of vitreous during the first three days, which afterwards completely disappeared. On the fourth day vision was 6/6. The conjunctival sutures were removed on the 10th day, and by the 14th day of the accident, there was a complete cure with 6/6 vision in both eyes and no incapacity.

Discussion. Dr. Mario-Esteban agreed with Drs. Marin Amat and Mansilla that the scleral route is the best for extracting foreign bodies located in the posterior segment of the eye. It is a more efficient and harmless procedure than the anterior route. I presented a similar case last year before this society to emphasize this point.

I think it is a wise procedure to produce superficial electrocoagulation as a prior step to sclerotomy, not only in order to prevent hemorrhage but also to avoid a secondary detachment of the retina. To this end it may also be advisable to cut the ocular membranes with an electric bistoury instead of with a knife.

Dr. Marin Amat (in closing), said that he wished to answer, at the same time, Drs. Mario Estaban and Carreras, and to affirm that he considered his technique of coagulation of the sclerotic and choroid and incision with the Graefe knife superior to their method of cutting the membranes with the electric knife. His reason is that the diathermy coagulation produces a better coagulation than is pro-

duced by perforation with a metallic filament. He feels so strongly about this point that every time he has to perforate the eye in the treatment of retinal detachment in order to let the subretinal fluid escape, he always does it over a region which has previously been coagulated so that there will be no complication of intra-ocular hemorrhages.

With reference to the probable subsequent detachment of the retina, it is clear that it could happen, but Dr. Marin Amat has never seen it. The preceding coagulation of the sclera and choroid would produce an exudative choroiditis. This would logically prevent such an occurrence by producing an adhesion of the two intraocular membranes along the site of the incision. Moreover, he performs posterior sclerotomy in the iridectomy operation for glaucoma, without getting subsequent detachment of the retina.

Joseph I. Pascal,
Translator.

CHICAGO
OPHTHALMOLOGICAL
SOCIETY

April 15, 1946

PETER C. KRONFELD, *president*

CLINICAL MEETING

(Presented by the staff of Loyola University Medical School, Department of Ophthalmology)

MALIGNANT EXOPHTHALMOS

DR. J. R. FITZGERALD presented I. M., a woman, aged 47 years, who was seen in consultation in November, 1944, when she was admitted to the hospital for thyroid surgery. The ocular symptoms consisted of lid swelling, epiphora, and a severe and constant neuralgic pain located behind the eyes. A firm, noninflammatory lid edema

was present, as were a nonobstructive and marked epiphora, and a marked retraction of the levator, but no significant exophthalmos. Other ocular findings were normal. Basal-metabolism rate was +39. Following complete ablation of the left lobe and removal of about 90 percent of the tissue of the right lobe of the thyroid, the systemic manifestations of thyroid overactivity disappeared, but the eye symptoms were not improved.

About one month following surgery it was quite evident that malignant exophthalmos was developing. Exophthalmos measured 25 mm. (Luedde) in each eye, and there was considerable resistance on attempts to compress the eyeballs into the orbit. Lid swelling and epiphora were much more apparent; the lacrimal gland was papable; diplopia was constantly present with complete immobility on attempts to rotate the eyes into the superior plane. The diplopia could be obliterated in the primary position by 6 diopters of vertical prisms. The ocular muscles could be palpated and seemed enlarged and taut. Reaction to prostigmine was negative. Vision was: O.D., 20/200, correctible to 20/20; O.S., 20/100, correctible to 20/25. The refractive error was a mild, compound myopic astigmatism. Visual fields were normal.

Six weeks following surgery the ocular situation had further deteriorated. There was almost complete external ophthalmoplegia, inferior rotation being retained to some extent. Severe chemosis was present with exposure keratitis manifest by superficial, punctate staining of the lower half of each cornea. The basal-metabolism rate was -7. The patient was again hospitalized and given 6 gr. of thyroid extract, daily; stilbestrol, 10 mg. daily; fluid limitation; sedation; local protective ocular therapy; and irradiation of the pituitary gland. X-ray studies of the sella turcica were negative. The re-

sponse within one week was excellent. During the next few weeks, the ocular motility improved markedly with lessening of diplopia and subsidence of pain. Seven months following surgery, the diplopia had disappeared subjectively; approximately 1.5 degrees of vertical imbalance remained. The exophthalmos still measured 24 to 25 mm. (Luedde). Rather complete paralysis of elevation remained; left lateral conjugate rotation was also slightly impaired. Cosmetically, the levator retraction is still a problem and a recession by the Goldstein technique is contemplated.

SIDEROSIS OF LENS AND VITREOUS

DR. J. R. FITZGERALD presented E. L., a man, aged 34 years, first seen in December, 1945, because of impaired vision in the right eye of 10 years' duration. He had been told, in 1936, that he had a congenital cataract. Vision was: O.D., 20/60, correctible to 20/30, no Jaeger; O.S., 20/15, J1 for near. In the right eye, a 2 to 3 mm., through and through, linear and vertical corneal scar was seen, located paracentrally at the 2:30-o'clock position, opposite the pupillary margin of the iris. A peculiar lens opacity, consisting of a dense brownish opacity surrounded by a cuff of whitish tissue, was located at the superior pole of the lens in the cortical zone, from which, extending downward toward the lenticular center, were two similarly colored pronglike opacities resembling the roots of a tooth, located in the anterior and posterior cortical zones. The posterior subcapsular zone was greenish-yellow.

Vitreous strands were thickened and clumped, nasally and below, and stained deep brown. A red reflex was present, but fundus details were too indistinct to be studied. Repeated tonometric examinations were within normal range. There was no evidence of active or

past inflammatory reaction; no atrophic changes were present in the iris; and no hole was visible. On maximal pupillary dilation, a small capsular rent was visible just inferior to the equator slightly nasally to the 12-o'clock position. X-ray pictures showed a small, metallic foreign body located somewhere in the anterior orbit or eyeball.

Additional history disclosed that, in 1932, while repairing a battery, something struck the patient's right eye. He consulted a doctor but nothing was found, and the eye healed without incident. In 1942, he was inducted into the army and was promptly hospitalized because of troublesome headaches. He spent four months in the hospital. Numerous X-ray studies were made. He believed that an intraocular foreign body was suspected, but no diagnosis, advice, or therapy was given.

CATARACTA COMPLICATA: MYOPIA

DR. E. A. ROLING presented S. C., a woman, aged 50 years, who was first seen in November, 1942, complaining of poor vision in both eyes. She stated that at five years of age she was struck in the right eye with a pellet from a slingshot, causing loss of vision. She was told at the time that she had a retinal detachment; no therapy was instituted. Vision has remained poor in that eye, and for the past several years vision in the left eye had gradually decreased. She had worn a correction for myopia for 20 years.

Vision in the right eye was ability to count fingers at six inches; in the left eye, 20/100. The right eye showed a mature cataract suggestive of cataracta complicata. There was good projection and perception of colored light, with a faint red reflex at the periphery of the lens. The left eye also showed an opacity of the lens, suggestive of a cataracta complicata, not so marked as in the right. The vitre-

ous was degenerative, the fundus showed degenerative myopic choroiditis.

One year later vision in the right eye was unchanged; that of the left eye had decreased to less than 20/200. A lens extraction was performed in the right eye. The postoperative course was slow but uncomplicated. Three months later vision could be corrected to 20/40; and one month later, with correction: -50D. cyl. ax. 90°, a vision of 20/25 was obtained; with a +3.00D. sph. added, she read J2 at 12 inches. Fundusoscopic examination showed moderate vitreous degeneration and degenerative myopic choroiditis, less in degree to that of the left eye.

RETROBULBAR ABSCESS

DR. E. A. ROLING presented P. A., a man, aged 50 years, who was first seen in September, 1945, with marked proptosis of the left eye. The lids were edematous and inflamed, and thick rolls of phlegmonous conjunctiva extruded through the palpebral opening. The bulb was completely frozen in the swollen soft tissues of the orbit. The cornea was exposed over the lower two thirds and was hazy. The media was cloudy, and fundus details could not be made out. Vision in the right eye was 20/40; in the left eye, nil. The patient's temperature was 102.4°F.

Three days following extraction of a tooth, two weeks previously, the left eye became red and painful. The eye was treated with hot applications, and sulfonamides were administered without improvement. Ten days after onset, the patient consulted an ophthalmologist and was immediately admitted to the hospital.

Under sodium-pentothal anesthesia, an aspiration of pus was attempted in order to localize any pocket of purulent material in the retrobulbar space. This was unsuccessful, and an incision was made through the skin at a junction between the inner one third and outer two thirds

of the orbit, just inferior to the superior orbital rim. Exploration was continued with blunt dissection until an abscess was encountered. A rubber drain was inserted deep in the retrobulbar space and the wound was left open. Therapy with penicillin and sulfadiazine in large doses was instituted. The wound drained freely; the temperature dropped; and the inflammation gradually resolved. At no time was there evidence of meningeal irritation. Vision in the right eye returned to 20/25, and the left eye remained blind. Two months later, there was only slight impairment of the ocular motility and beginning optic atrophy in the left eye. At present the ocular motility is normal, the optic nerve is atrophied, and there is a slight symblepharon of the lower lid.

SCIENTIFIC PROGRAM

Complications of intracapsular extraction. Dr. Samuel J. Meyer.

Peripheral vision and experimental anoxia. Dr. Ward C. Halstead (by invitation).

Subdural hematomas in infants and adults. Dr. Frank W. Walsh (by invitation).

Richard C. Gamble,
Secretary.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

March 19, 1946

DR. HOWARD F. HILL, *presiding*

PENICILLIN IN OPHTHALMOLOGY

DR. EDWIN B. DUNPHY said that penicillin is usually superior to the sulfonamides for the following reasons:

1. It is generally nontoxic by all routes of administration.
2. Its antibacterial action is not in-

hibited by autolytic products and secretions.

3. It has little, if any, deleterious effects on the regeneration of corneal epithelium.

4. It is not incompatible with other drugs commonly used, such as atropine, cocaine, procaine, sulfadiazine, and so forth.

With these advantages, Dr. Dunphy said, it should be the drug of choice in treating any ocular infection known to be due to penicillin-sensitive organisms.

However, unless certain basic facts are understood regarding its distribution in the ocular tissues by various methods of administration, many cases will not be treated effectively, and much valuable time will be lost before the ocular infection can be brought under control.

The weight of experimental evidence seems to indicate the following recommendations for treating eyes infected with penicillin-sensitive organisms.

1. Intramuscular and intravenous injections of penicillin will probably have little effect in controlling infections of the anterior and vitreous chambers.

2. Subconjunctival injections may have some effect on infections of the anterior chamber, but are probably worthless in infections of the vitreous.

3. Injections of the vitreous can probably be most effectively treated by a single intravitreal injection of 0.1 cc. of penicillin solution containing not more than 500 units.

4. Infections of the anterior chamber will probably be controlled by local application of saturated cotton packs, or by iontophoresis. Corneal baths and subconjunctival injections will probably be less effective. In cases of perforating corneal injury with damage to the lens, a single injection of 0.1 cc. of a solution of penicillin containing not more than 500 units may be justified.

5. For conjunctivitis and infectious corneal ulcers, frequent instillations of penicillin drops or ointment will probably be effective. Saturated cotton packs under the lids, iontophoresis, or corneal baths should be tried in very severe cases.

Mahlon T. Easton,
Reporter.

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ESTABLISHMENT OF AN AMERICAN BOARD OF OPTICIANRY

One of the most vital elements in the practice of many ophthalmologists is the opticians to whom they refer their patients for the filling of their prescriptions.

There are those ophthalmologists who are so situated that they cannot allocate this phase of their practice to an op-

tician and who must, therefore, handle it themselves, and there are a few to whom the service is available but who do not care to use it, for one reason or another, but for those who have been fortunate enough to have had an association with a well-trained optician, there can never be enough said in praise of this helpmate.

How often has he borne the brunt of complaints for unsatisfactory glasses, and often, I am sure, when the blame should have been placed elsewhere! How

often has he made requested adjustments and changed lenses without charge to the patient in order to be of service to the physician. His must often be a trying and difficult task. At times, because of his better knowledge, perhaps, of newer designs in frames and bifocal segments, and even—be it hesitantly suggested—better information on practical optics, on him falls the burden of suggesting tactfully to the doctor that certain changes be made in the construction of the lenses.

There are some opticians, naturally, who are not so well trained, even if equally well intentioned, as others, and it is because of this fact that the idea for some means of educational standardization for opticians was born. It is recognized that many good opticians have risen from the ranks of errand and bench boys in the shops, having been trained only by the method of practical instruction and such reading as they cared to do on the subject. Although some of them have made a good job of it, the fact remains that many are inadequately trained and that there is an enormous difference in their qualifications.

Today the demand for more thoroughly trained opticians is even more pressing than in the past because of the great advances in lens construction with the incident increase in variety of optical possibility offered to the public. To be conversant with what is best for the patient involves a knowledge of optics, of lens making, and of many kindred subjects including a reasonable understanding of ophthalmology.

An ophthalmologist who has had particular awareness of the need for better instruction for opticians has been Dr. William L. Benedict, Director of the Ophthalmological Division of The Mayo Clinic. Primarily through his efforts, there has been initiated in the Rochester Junior College a two-year course in Op-

ticianry, a term coined by Dr. Benedict. The theoretical instruction is given under the auspices of the school and the practical work by officers in the Benson Optical Company.

With full realization of the need for some means of evaluating the education of opticians and of standardizing their training, a group of those interested met in Chicago in January of this year and undertook the organization of an American Board of Opticianry. The model was that of the American boards of various specialties in which the American Board of Ophthalmology was the pioneer. The following organizations were instrumental in formulating the idea, and their representatives were included in the plans for the Board:

1. American Society of Contact Lens Technicians.
2. Association of Independent Optical Wholesalers.
3. Guild of Prescription Opticians of America.
4. Optical Wholesalers National Association.

Among the guests was William L. Benedict, M.D., who, by invitation, read a paper on "Recommendations for Creating a Board of Registration for Opticians." Charles Sheard, Ph.D., then emphasized the importance and necessity of adequate education to be followed by an apprenticeship of several years with final examination and certification by the Board of Opticianry as "Master Ophthalmic Optician."

There was to be an advisory educational and professional council to "... consist of not less than three and not more than five members, one of whom shall be engaged in the practice of ophthalmology, one engaged in the practice of optometry, and one who shall be an educator and/or research worker in ophthalmological optics or in the broader

field of physiological optics. . . ."

An outline of a two-year course of training has been sketched. This is to be followed by at least a five-year apprenticeship before the candidate is permitted to apply for certification as Master Ophthalmic Optician. A list of those companies, groups of individuals, or individuals who have been accredited as satisfactory for giving the practical training is to be published.

This training is specified to consist of not less than one year of ophthalmic lens grinding with 40 hours per week, two years of ophthalmic lens finishing with 40 hours per week, and two years of ophthalmic dispensing with 40 hours per week.

The two ideas, one for the establishment of suitable schools for training in opticianry and the other for the formation of a Board of Opticianry, appear fundamentally sound. There is little on which to build at present so that the project will take a long time before it can function adequately. With courage and persistence and infinite patience, however, the purpose can undoubtedly be accomplished. Ophthalmologists and optometrists should give the idea wholehearted support. The former for reasons obvious to ophthalmologists, and the latter for the same reasons—although these are less obvious to ophthalmologists because many of them fail to realize that the practice of many optometrists in large centers is similar to their own in that some of them refer their optical work to opticians. Somewhat beside the point is the related thought that if and when optometrists make a charge to the patient for their professional services, as a very limited number now do, they will not need to depend for their living on profit from the sale of glasses or on rebates from opticians, as is often the case now; and this latter practice might, with ophthalmolo-

gists' coöperation, be stopped and the cost of glasses to the public be reduced.

Having digressed thus far, the writer cannot resist the temptation to reaffirm his often given views on the practice of ophthalmology as concerns refraction. The occasion is because among the excellent papers presented at the organization meeting of the American Board of Opticianry, one writer voiced the sentiment, so often heard from optometrists, that the logical ultimate division of fields of activities might well yield all refraction to optometrists. To this writer that would be the knell of ophthalmology as a specialty.

Half of an ophthalmologist's life is over by the time he has completed his professional training. Ten years more must elapse before his surgical practice amounts to much, even when he is most favorably situated. It is rare indeed for surgery to be his major source of income before he is 50 years of age, and there are many to whom this never occurs. The medical phase of his practice comes earlier. In the practice of most ophthalmologists, however, the medical and surgical parts are always secondary to the refractive portion.

If this is taken from them, only very large cities will be able to support an ophthalmologist. Even there, he would have so many lean years that the field would attract almost no one, and the specialty would have to be included with general surgery where it would languish and deteriorate, a step backward of a hundred years.

Furthermore, refraction of the patient completes the surgical or medical care of the case. It is so intimate a part of the patient's care that it cannot be satisfactorily divorced from it. Since it rounds out the whole treatment and is the logical termination of the case, it should be handled by the one who has

performed the surgery or given the medical care.

No, if there is ever to be general accord between ophthalmologists and optometrists, it must be on the basis of acknowledgment by both that the practice of refraction belongs naturally and legitimately to both.

Lawrence T. Post.

SENSITIVITY FROM TOPICAL USE OF SULFONAMIDES AND PENICILLIN: A WARNING

Recently, while combing the literature for newer developments in the field of ocular therapeutics, I was struck by the widespread, and at times indiscriminate, use of the sulfonamides and penicillin. These miracle-working drugs have a definite and important place in our therapeutic armament, but the indications for their use are now rather well defined and well understood. From the literature it seemed apparent that many ophthalmologists are unaware of the fact that the local use of these drugs, particularly the needlessly long use, may produce a sensitivity to the drugs that would prevent their life-saving use for a later, more serious general infection.

Induced sensitivity from topical use of the sulfonamides is well known to all dermatologists. The reaction consists of a dermatitis of varying severity. In the majority of cases the reactions followed the local use of the drugs in ointment form. It has been found that the local use of sulfathiazole in even infinitesimal doses can induce this sensitivity.

All of us are aware of the fact that ophthalmic ointments can cause a local reaction. This sensitivity is sufficient to produce a severe reaction if the drug is used systemically. In addition to the se-

vere exfoliative dermatitis, the function of the kidneys may be affected, producing anuria, and the blood may show the well-known changes in its structure.

It has been said that, if an individual develops a sensitivity to one of the sulfonamides, another member of the group can be used without danger. There are, however, a number of instances in the literature where individuals who have been sensitized to one member of the group by means of local use have developed a severe dermatitis after the oral administration of another type of sulfonamide. Many internists are very reluctant to give any form of sulfonamide if the patient has ever had a skin reaction to any of the group. Indications are that this sensitivity may last many months and perhaps years.

Experience has shown that the local use of the sulfonamides in the eye is less apt to produce sensitivity than their use on the skin. The use of the sulfonamides in otolaryngology has confirmed the fact that their local use on the mucous membranes can produce sensitivity. There is a striking case reported in the literature of a man who used nose drops containing one of the sulfonamides. Later he developed a pneumonia for which he was given a sulfonamide. A severe exfoliative dermatitis and anuria followed, resulting in his death. There have been a number of authors who have condemned the routine use of the drug in the treatment of the common cold.

Although the generalized use of penicillin is more recent, it is also apparent that there is a tendency to develop a sensitivity to this drug. This sensitivity may be manifested as an immediate reaction or as a delayed one. The delayed or acquired sensitivity may be produced by repeated local application. Reactions have also been seen in the skin and eyelids of individuals who are in contact with the

drug during its preparation for administration. Tests have shown that this acquired sensitivity may be of short duration or it may last for a considerable period, even months, and it is conceivable that it may be permanent.

From the literature it is apparent that the serious ocular infections that respond to the sulfonamides and penicillin do so in a relatively short time. For example, in almost all of the reports on ophthalmia neonatorum the authors stressed the fact that the condition cleared in 24 to 48 hours in most cases and that all were cured before six days. In spite of this knowledge, it is customary in some quarters to use these drugs over a long period of time without regard of the possibility that the patient may be developing a sensitivity.

A personal discussion with Thygeson on this subject brought out some points that it seems well to emphasize: (1) Sulfadiazine is just as effective in the eye as other forms of the sulfonamides, is less toxic, and is less apt to produce sensitivity. (2) The sulfonamides should not be used longer than two months. (3) Unless there is some definite indication for penicillin, it should not be used; it is important to avoid the development of a sensitivity that would prevent its use in a more serious condition. (4) If penicillin is employed, it should be used at frequent intervals and should not be used locally longer than two weeks.

As ophthalmologists let us not jeopardize our patient's future by producing a sensitivity to these drugs as the result of their injudicious use for some rather trivial eye condition or as the result of their needless use over too long a period of time. It must be kept in mind that the sensitivity induced may mean the inability to use these life-saving drugs in later years when they alone can preserve life.

Frederick C. Cordes.

BOOK REVIEWS

MEDICINE IN THE CHANGING ORDER. Report of the New York Academy of Medicine, Committee on Medicine and the Changing Order. The Commonwealth Fund, 1947. 232 pages. Price, \$2.00.

The New York Academy of Medicine organized a committee about four years ago for the study of modern trends in medicine. In this book the subject is fully discussed. The work was based on many original monographs about related subjects. The committee was composed of more than 50 distinguished doctors, nurses, and laymen. The product of their efforts is worthy of the group. The scope of the inquiry is tremendous and obviously a Herculean effort has been put into this book. In the reviewer's mind it is the most thoughtful publication thus far concerning the future of medicine in America and should be read by every physician because it concerns him most intimately.

After a preamble which discusses the origins of the present problems, reviews medical care as it has developed in America and also considers some of the reasons for the trends that it has followed, the status of medical care in rural and in urban areas is given.

A summary of recommendations on the extension of medical care in urban communities is divided into the needs of: (1) middle-income families, (2) the medically indigent; and (3) the indigent. The statement is made that for the middle-income families voluntary, nonprofit insurance plans should be provided and that these can best function through group-practice units. As complete coverage as possible, except for the hospitalization of chronic illnesses, should be provided. If necessary, government funds should be used to subsidize the

risks of establishment and early deficits. The medically indigent should be handled by prepayment, nonprofit insurance plans in which the patient pays only a part of the premium, the rest being met by local, state, or federal funds. The indigent should be cared for by improved facilities in tax-supported municipal hospitals and health centers, with municipal subsidies to improve nonprofit institutions and staffs. A panel of physicians should give office and home care to these people. A medical committee should be set up in each city for advising the municipal agency that extends government subsidies to health institutions and to nonprofit insurance plans.

Situations in rural districts, which are much worse than in urban areas, are to be met primarily by an expansion of federal, state, and local public-health services. Qualified doctors, whose salaries are augmented by municipal, federal, or state grants, should be employed. Mobile clinics are recommended and, as the heart of the undertaking, new hospitals and health centers are to be strategically distributed throughout the country. Here again federal funds are to be utilized, the amounts depending on the local situation.

The next chapter considers the extension of the aforementioned public-health services which are now fairly adequate in some few states, only partially adequate in some others, and completely inadequate in the remainder. A recommendation is made that the federal administration consolidate all health functions in the Public Health Service and that this should eventually be elevated to departmental status. A consolidation of state health activities is badly needed. Too many departments, such as Welfare, Labor, and Agriculture, are involved in the present arrangements.

The quality of medical care, as distinct from the quantity, is stressed, it being recognized that the two are not necessarily interdependent and that if the quality deteriorates, the increase of quantitative care is futile.

Education of medical students, particularly the abandonment of discrimination against women and minority groups, is discussed together with the present economic discrimination. Pertinent suggestions are that preventive medicine should be employed to a greater extent than at present. Each case should be studied with the thought in mind as to why the condition was not forestalled. It is also suggested that the student should have more instruction in medical practice in the home than he now does. Economics point to the impossibility of giving good medical education at a price that the student can pay. Government aid seems the answer to the writers of this book.

Another thought is that clinical training should begin with the first year of medical school, and that the basic courses should not be given in an isolated manner but directly in relation to the care of the patient. For the best training of interns they should be under the supervision of the medical school. Too often an intern is merely an employee of a hospital and carries such a mechanical burden that he does not have time to advance intellectually. It is argued that medical schools should have some contacts with their graduates' training. The idea is advanced that possibly medical schools, presumably accepted ones, might well have the licensing power of the physicians whom they have taught. Then follows a discussion of group practice. To the writers this seems to be a most desirable development.

A chapter on preventive medicine

points out as a preliminary that preventive medicine applies to those practices which only the individual is capable of applying to his own benefit; whereas, public health is a community responsibility. Prevention is tremendously stressed. The physician should be prepared to advise the patient not only on how to get well, but on how to keep well, and every individual should be educated to the importance of demanding this information from his doctor.

The history of the development of hospitals in America is a fascinating chapter. It discusses many aspects, not the least important being the financial, which includes the increasing costs to patients of hospital care. The necessity of this in the overall expanded program is, however, obvious. This chapter concludes with 22 recommendations for more efficient hospitals. Among these, the most important are a further integration of in-patient and out-patient services, with the enlargement of the latter and the extending of the hours of service into the evenings. The need for more graduate practical nurses is given. In this instance, as in others, the unequal distribution of service is mentioned. In New York state, the ratio of graduate nurses to population, in 1943, is given as 1:620; while in Mississippi, it was only 1:4,958. Although many more trained nurses are needed, the urgency for practical nurses is, perhaps, even greater.

Perhaps the crux of the whole problem is contained in the discussion of medical insurance. The committee strongly urges an extension of the voluntary insurance plans, which have been tried in many states and which, in general, have proved successful, rather than the establishment of drastic and irrevocable compulsory health-insurance schemes, such as those

outlined in the Wagner-Murray-Dingell bill, which have no experience to back them.

A glance at the italicized paragraph headings of this culminating chapter, gives one a fair idea of the whole discussion. "In extending medical service and perfecting its organization, quality must be preserved. Provision of public health services is a prime essential. Improvement in medical service requires effective use of hospitals with adequate facilities. Success will require trained professional and nonprofessional personnel. For optimal results, organization and coöperation of physicians are required. In the improvement of medical services, voluntary prepayment plans are needed. Extensive education for both physicians and the public will be required. Progress in the extension of medical service must be varied and adapted in each instance to the needs of the community. Government aid will be required."

Lawrence T. Post.

TRANSACTIONS OF THE OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM. Volume LXV. London, J. and A. Churchill, Ltd., 1945. 424 pages.

The abundance of medical and surgical material cast off by war has always been followed by advances in medical knowledge and surgical skill. The excellent "Discussion on the Ocular Sequelae of Head Injuries" and the "Discussion on Plastic Repair of the Lids" carry the weight of authority gained from actual experience. The ocular sequelae of head injuries are presented in the following order: (1) optic nerve, (2) optic chiasma, (3) optic tract and radiations, (4) visual cortex, (5) visual disorientations,

(6) neuromuscular aspects, (7) the visual fields, and (8) the orthoptic treatment of ocular muscle imbalance following head injuries. This is controversial. The psychological benefit is noted frequently.

"The technique of plastic surgery is like that of eye surgery. Every maneuver must be precise, purposeful, clean, and finished. The handling of tissue must be the minimum." This quotation from Stalard's article is repeatedly confirmed by the very fine case reports and photographs presented. The lessons of World War I which have been so thoroughly taught by John Martin Wheeler have been verified again in the field of plastic surgery.

The Doyne Lecture, "On Compression and Invasion of the Optic Nerves and Chiasma by Neighboring Gliomas," is of considerable historic interest in revealing the development and recognition of the syndrome which was first presented in an extended form by Foster Kennedy.

Many individual case reports are scattered through the transactions.

William M. James.

CORRESPONDENCE

GLAUCOMA FOLLOWING INGESTION OF SULFATHIAZOLE

Editor,

American Journal of Ophthalmology:

In the February, 1947, issue of the JOURNAL is an article by Fritz and Kesert reporting a case of glaucoma caused by sulfathiazole. The diagnosis of acute congestive glaucoma in the case reported is seriously questioned on the following counts:

1. The vision of either eye was corrected to normal by glasses.

2. The pupils were small and irregular.

3. The fundus was recorded as normal through undilated pupils.

4. The pupils, three days after the original acute attack, were normal in size and reacted briskly to light and accommodation despite the fact that eserine was being used in both eyes.

There is no doubt, from the case reported, that the patient was allergic to sulfathiazole. The edema of the lids and the chemosis, plus the intense itching and burning, were indicative of an allergic reaction. The incidental increase in pressure is not to be regarded as acute congestive glaucoma because the pupils were not dilated, the fundus could be seen, and the visual acuity was normal with glasses.

I think the authors have made a mistake. All acute inflammatory diseases bringing about edema and chemosis may be attended by increased pressure of the eyeball by purely a mechanical process. Acute iritis and acute anterior uveitis may be attended by increased intraocular pressure. These experiences which register a higher than normal tension on the tonometer are not to be regarded as acute congestive glaucoma.

(Signed) Louis Lehrfeld,
Philadelphia, Pennsylvania.

Editor,

American Journal of Ophthalmology:

Because of the difficulty in arranging a conference with Dr. Kesert, I will undertake to answer Dr. Lehrfeld's letter, assuming full responsibility therefore and not presuming, of course, to speak for Dr. Kesert, who might not subscribe fully to what I write.

Dr. Lehrfeld thinks that we were mistaken in our diagnosis. Indeed it is pos-

sible that we were. However, two well-known ophthalmologists, editors of the JOURNAL, saw the patient with us and agreed with the diagnosis and treatment.

Dr. Lehrfeld agrees that this attack of ocular disease was an allergic phenomenon. It certainly was acute. The turgid condition of the ciliary and conjunctival vessels made it appear congestive, and the increased tension relieved by eserine meant glaucoma as we are accustomed to think of the condition. We were struck by the good visual acuity, the small irregular pupils, and the clear corneas, but, because these findings were at variance with the classical picture of acute congestive glaucoma, we did not feel that the diagnosis was in doubt.

In classic, acute, congestive glaucoma, when promptly and successfully treated, a normal fundus has been recorded frequently. The pupillary reaction, as re-

corded on the third day after the original attack, we attributed to accidental omission of the prescribed therapy. We are aware of the glaucomas complicating anterior uveitis, and we like to believe that in two eyes as angrily red as this patient's were that the slitlamp and corneal microscope would have revealed a cell or two in the anterior chamber. This was not the case. We also believe that, instead of promptly relieving the condition, eserine would have made it much worse had a uveitis been present. Inflammatory diseases of the uveal tract may be attended by increased pressure of the eyeball by purely a mechanical process, as Dr. Lehrfeld said. In this case we believe that the mechanism was the same, but that the basic cause was not inflammatory but allergic in nature.

(Signed) Milo H. Fritz,
New York, New York.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

1

GENERAL METHODS OF DIAGNOSIS

Cristini, G. The value and limits of color perimetry. *Rassegna Ital. d'Ottal.*, 1946, v. 15, Sept.-Oct., pp. 381-405.

For practical purposes, colored test targets are really useful only in the central fields. (13 figures.)

Eugene M. Blake.

Duguet, J. Functional visual examination in aviation. *Ann. d'Ocul.*, 1946, v. 179, Sept., pp. 463-480.

The methods and instruments most frequently used in the visual examination of French and other aviators are briefly discussed. Visual acuity is preferably tested in France with the optometer of Beyne with illumination of 15 lux at a distance of 5 meters and the broken ring of Landolt. The oculomotor mechanism is preferably measured with the Maddox rod or the Remy diploscope. At the International Conference of Aviation in Montreal in 1946, the maximum adopted for pilots of civilian transports and military aviators were: esophoria, 10 degrees; exophoria,

5 degrees; hyperphoria, 1 degree. Binocular and stereoscopic vision is measured stereoscopically and with the Howard-Dollman apparatus, in which 30 mm. is the acceptable limit at 6 meters. Color vision is measured first with isochromatic charts and then with colored lanterns. Of isochromatic charts, the ninth edition of Ishihara published by Lewis in England in 1943 is considered satisfactory. The American edition published by the American Optical Company was found subject to a 25-percent error. Of the lanterns used, the chroometre of Mehaute-Guerin and the lanterns of Green and Giles Archer were considered most satisfactory. Night vision may be satisfactorily tested with the AAF night vision tester (Eastman U.S.A.), Royal Air Force hexagon (Gr. Brit.), the method of Beyne and Worms (French), the Hecht-Schaler night vision tester (USA), or the adaptometer of Wilson (Gr. Brit.). (13 references.)

Chas. A. Bahn.

Paradoksov, L. F. Correction in the localization of an intraocular foreign

body in incorrect position of the eyeball during roentgenography. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 59-61.

Paradoksov gives tables for computing the error when the eyeball was deviating from the correct position during localizing roentgenography.

Ray K. Daily.

Pignalosa, G. Red free ophthalmoscopy. *Riv. di Oftalm.*, 1946, v. 1, July-Aug., pp. 510-529.

The history, method, and clinical and physiological importance of red free ophthalmoscopy is comprehensively discussed. . . . K. W. Ascher.

2

THERAPEUTICS AND OPERATIONS

Arentsen, Juan. Infiltration of penicillin dissolved in 2-percent novocaine in localized bacterial inflammations. *El Día Médico* (Buenos Aires), 1946, v. 18, Dec. 9, pp. 1950-1954.

The author advocates the infiltration of infected tissues with a solution of 3000 Oxford units of penicillin per c.c. of procaine solution. The penicillin is not applied on or in the infected wound but the surrounding inflamed tissue must be infiltrated. It can be applied in any stage of the evolution of infection. The treatment is painless, efficacious, and can be used in inflammations of the eye and its adnexa as safely as in other organs. F. H. Haessler.

Avgushevich, P. L. Oxygen therapy in ocular war injuries. *Vestnik Oft.*, 1945, v. 24, pt. 4, pp. 28-31.

Subconjunctival oxygen insufflation is advocated for the absorption of traumatic corneal exudates, stimulating epithelization, and relieving subjective symptoms. It is also effective for stimulating the absorption of lens masses

in the anterior chamber in traumatic cataract, and of fresh hemorrhages in the vitreous. The technic consists in insufflating oxygen subconjunctivally through a needle. Ray K. Daily.

Benstein, I. I. The action of calcium iontophoresis on the specific sensitivity of eyes of tuberculous animals. *Vestnik Oft.*, 1946, v. 25, pt. 6, pp. 13-17.

A laboratory investigation of calcium iontophoresis in ocular tuberculosis is reported. In experimental corneal tuberculosis it affects favorably the course of the tuberculous process and reduces the local sensitivity. The application of iontophoresis produces no irritating symptoms, and alleviates the inflammatory phenomena. The development of tuberculous granuloma is arrested. The lesion becomes sharply demarcated from healthy tissue and never reaches caseation. The effect of the iontophoresis on the Mantoux reaction is less marked than the local effect, but nevertheless manifests itself by a shift towards desensitization. The lowered sensitivity of the skin was present in animals infected directly in the eyeball, as well as in those infected hematogenously. Ray K. Daily.

Bursuk, G. G. Substitutes for protein therapy and their choice in war-time. *Vestnik Oft.*, 1945, v. 24, pt. 3, pp. 32-35.

As criteria of effectiveness of an injection of a therapeutic agent Bursuk used his evaluation of the clinical improvement and a measurement of the sedimentation rate. He found that injections of milk, cod liver oil, 1-percent potassium permanganate solution, sulphur, 10-percent sodium chloride solution, sterilized egg yolk, hot air, and water were equally effective. He con-

cludes that the favorable effect is due not to the specific action of the injected agent on the inflammatory process, but to the action of some products which appear to be liberated in the tissues of the patient in response to the irritation produced by the injection.

Ray K. Daily.

Carmi, A. Therapeutic action of cobra venom in ophthalmology. *Rassegna Ital. d'Ottal.*, 1946, v. 15, Sept.-Oct. pp. 437-439.

Carmi cites the advantages of snake venom in ocular therapeutics and quotes Calmette's extensive experiments with the poison of various classes of snakes. A weak solution of cobra venom instilled into the conjunctiva, has a sedative effect. Subcutaneously used it relieves the pain of neoplasms through vasodilation. The capillaries of the fundus undergo a similar dilation. It is thus useful in the optic nerve atrophy of arteriosclerosis and chorioretinitis. Other conditions said to be benefited by the venom are retrobulbar neuritis, retinal hemorrhages, myopic chorioretinitis, primary optic atrophy, and pigmentary degeneration of the retina. Eugene M. Blake.

Chentzov, A. G. Tissue therapy data at the Eye Clinic of the First Moscow Medical Institute. *Vestnik Oft.*, 1946, v. 25, pt. 1, pp. 30-34.

This form of therapy was tried on 66 patients with myopic degeneration at the macula, retinal hemorrhages, vitreous opacities, retinal detachment, optic atrophy, uveitis, and keratitis. The results were encouraging, if not as good as those reported by Filatov; he ascribes the disparity in results to faults in technic. He regards tissue therapy as a new method of foreign protein therapy, with action different

from that of lactotherapy. The effectiveness of mobilizing the resisting forces of an organism is generally recognized; biogenic stimulants bring additional strength to the regenerative powers of an organism attacked by disease.

Ray K. Daily.

Cossu, D. The use of Roentgen rays in the prevention of operative hemorrhage. *Rassegna Ital. d'Ottal.*, 1942, v. 11, March-April, p. 136.

For the prevention of operative hemorrhage and for the rapid absorption of extravasated blood, Cossu found X-ray treatment of the liver and spleen beneficial. It is indicated especially in operations where rubeosis iridis is a complication, or where one fears an intraocular hemorrhage. This treatment does not appear to be of value in severe trauma. Eugene M. Blake.

Fieandt, Olaf. A case of transitory myopia following radium irradiation. *Acta Ophth.*, 1941, v. 19, pt. 1, pp. 11-14.

Following a post-operative irradiation of the right eyeball for a basal cell carcinoma, with 30 mg. of radium for four hours, a 29-year-old student developed a transitory myopia, which cleared up within ten days. He had, in addition, some conjunctival irritation, and small atrophic spots in the conjunctiva of the lids. The myopia is attributed to edema of the lens, and to a ciliary spasm. Ray K. Daily.

Filatov, V. P. Methods of tissue therapy—biogenic stimulation. *Vestnik Oft.* 1946, v. 25, pt. 1, pp. 3-9.

In the process of perfecting keratoplasty Filatov developed a new therapeutic procedure, that of tissue therapy. The idea found scientific support in the fact that in tissue cultures in vitro

the addition of a fresh piece of tissue stimulates the growth of the old pieces. In 1933 Filatov published his method for increasing the transparency of a corneal transplant with partial corneal transplantation adjacent to the transplant. He later discovered that tissue preserved on ice acted more effectively than fresh tissue. From experiments with various tissues the conclusion emerged that any human, animal or plant tissue under certain unfavorable conditions develops products which, when used therapeutically, exert a favorable nonspecific effect on the entire range of ocular diseases. Biogenic stimulants were also found effective in diseases of the skin, the joints, and the female genital organs. The investigations were extended into the sphere of biology and botany. The germination of seeds was hastened by soaking them in tissue extracts. The investigations of the nature of the biogenic stimulants showed that trauma to plants leads to the formation of traumatinic acid, which belongs to the dicarbon group and is a powerful stimulant to cell proliferation. This acid was extracted from plants and was subsequently synthesized. Such biologic activators also develop within a sick organism under the influence of unfavorable conditions; perhaps the favorable effect on some diseases of chemical substances, cold, hunger, and intercurrent diseases may be attributed to the same process. The development of biogenic stimulants within an organism requires great care. The introduction of prepared stimulants is safer, can be done with less trauma to the organism, and acts equally well on lues, tuberculosis and some other diseases. Biogenic stimulators raise the metabolism of the cell, stimulate its function, and probably increase the fermentation capacities of

tissue albumens. This form of therapy is an adjuvant to other indicated therapeutic procedures, and should be used in conjunction with them.

The technic of tissue conservation and administration has changed with years of clinical experience. The newest form is that of implantation of autoclaved tissues and injections of their extracts. Detailed instructions are given for the preparation of extracts and their administration, and implantation of autoclaved cadaver skin, fresh organs, placenta, animal skin, and leaves of aloes. 'Ray K. Daily.

Foster, John. Certain operations on the superior oblique. *Brit. Jour. Opth.*, 1946, v. 30, Nov., pp. 676-682.

The relative rarity of direct operations on the superior oblique tendon impells the author to add three of his own. In the first a marked cyclophoria and vertical diplopia caused by traumatic paresis of the superior oblique were not relieved by tenotomy of the contralateral inferior rectus. By the method of Wheeler, the paretic muscle was advanced with a very good result. The second case was one of paresis of both the superior oblique and lateral rectus muscles of the same eye. At operation the internal rectus was recessed 6 mm., the outer halves of the superior and inferior recti were sutured to the insertion of the external rectus and the superior oblique was tucked 6 mm. Results were very satisfactory. In the third case traumatic adhesions around the inferior rectus could not be relieved by surgery. The superior oblique of the other eye was recessed 8 mm., with reasonably good results. (4 illustrations.) Morris Kaplan.

Gill, W. D. An aid in facilitating postoperative dressing of the eye in

patients with akinesis of lids. *Arch. of Ophth.*, 1947, v. 37, Jan., pp. 82-83.

Several years ago the author called attention to a simple method of maintaining postoperative closure of the eyelids after akinesis of the orbicularis oculi muscle had been employed, which consisted in sealing the lashes of the upper lid to the lower lid by means of a small droplet of collodion. More recently, in order to facilitate opening the lids and breaking the collodion seal, a short length of silk suture is introduced beneath the lashes after the eyelids have been closed and sealed with collodion. This can be accomplished before the sealing, but in such instances particular care has to be exercised to avoid incorporating the silk suture in the collodion droplet. When this silk suture is in position, its ends are brought together and draped onto the cheek below the eyelid; the two ends are tied together and the customary dressing is applied. When the time comes to inspect the eye, it is a simple matter to grasp the ends of the silk suture and, with gentle traction, to separate the lids. R. W. Danielson.

Hughes, W. F. Treatment of lewisite burns of the eye with dimercaprol ("BAL"). *Arch. of Ophth.*, 1947, v. 37, Jan., pp. 25-41.

Exposure of the eye to relatively small quantities of liquid or vapor lewisite produces a devastating ocular lesion. The progressive nature of such a burn is caused by the arsenical component of this war gas. To free the tissues from arsenic after exposure to lewisite, English workers synthesized dimercaprol ("BAL"). The work here reported from the laboratories of the Wilmer Ophthalmological Institute was devoted to the determination of

the optimum conditions for the use of this antidote, its mode of action and its limitations.

Lewisite is immediately hydrolyzed at the site of contact with the moist surface of the eye, liberating enough hydrochloric acid to produce a superficial corneal opacity. Within two to four minutes after exposure to lewisite followed by closure of the lids, all toxic arsenical material disappears from the surface of the cornea, and within two minutes the drug can be demonstrated in the aqueous. Beginning ten minutes after exposure and becoming well marked in thirty minutes, irreversible histologic changes in the cornea can be detected.

A single instillation of 5-percent dimercaprol solution or ointment within two to five minutes after exposure to lewisite effectively prevents the development of serious ocular lesions. This excellent therapeutic effect of dimercaprol is due, in part at least, to its rapid penetration and withdrawal of toxic arsenical material from the tissues before irreversible histologic changes have developed.

R. W. Danielson.

Iosefova, F. I. Antireticular cytotoxic serum in the therapy of ocular tuberculosis. *Vestnik Oft.*, 1946, v. 25, pt. 6, pp. 31-33.

A report of cases illustrates the effect of this remedy on the various types of metastatic ocular tuberculosis. It was found useful in chronic torpid keratitis profunda. It stimulates the physiologic function of connective tissue, and absorption and regression of the infiltration in the opaque cornea seems to follow. In patients with fresh chorioretinitis and periphlebitis it produces fresh hemorrhages and increased ret-

inal edema and should therefore be used with great caution.

Ray K. Daily.

Jona, Sergio. Investigations concerning the action of three drugs of the adrenaline group (sympamine, sympathol, veritol) on the normal human eye. *Riv. Neuro-Oto-Oft.*, 1941, v. 18, no. 4, pp. 312-334.

The author administered the drugs named in rather high doses to study their influence on pupillary diameter, intraocular vascular pressure, caliber of the intraocular vessels, and ocular tension. Measurements were performed before oral, intramuscular, or intravenous administration and for one hour after, at five-minute intervals. The dosage of sympamine was 3 centigrams oral or intramuscular, of sympathol 6 centigrams were given intravenously or 30 centigrams intramuscularly, and of veritol 1 centigram intravenously, 2 centigrams intramuscularly, or 7.5 centigrams orally. Eight full-page tables illustrate the action on the normal human eye: there were but slight variations of both the pupillary diameter and the ocular tension. Other authors have reported marked effects when the same drugs were given by instillation and subconjunctival injection. The retinal arteries showed a very slight dilatation after sympamine administration, and a slight but inconsistent constriction after sympathol and veritol. Sympamine produced a decrease of the intraocular arterial pressure which rose after administration of sympathol and of veritol.

K. W. Ascher.

Kenel, C. Leeches and hirudine in ophthalmology. *Ann. d'Ocul.*, 1946, v. 179, May, pp. 296-305.

After a historical resumé of the uses of leeches in ophthalmology and general medicine, the chemical and other qualities of a deuterio-albuminose, hirudine, which is prepared from the head of leeches, is described in detail. It inhibits blood coagulation, produces a basic increase of fibrinogen and globulins, is a local lymphagogue, is bactericidal and vasodilative. It is not toxic if given intravenously but does increase the toxicity of mercury. In iritis and vascular hypertension with eye or head pain the use of leeches or hirudine is followed by reduction of pain which is more rapid and complete than that which follows the use of artificial leeches. Leeches infected with anthrax did not communicate the disease to experimental animals. The relief of a pain following the use of leeches is apparently due to their indirect action on the cerebrospinal fluid. Three applications of two leeches are used over the mastoid region at 36 to 48-hour intervals. In Switzerland the use of leeches has greatly increased during the past ten years, and more than 300,000 leeches were used in France during 1944. Hypertension in glaucoma is lowered and pain is greatly reduced after the use of leeches. Liquimine and dicouramine are not considered as effective as hirudine.

Chas. A. Bahn.

Kirby, D. B. Emergency ophthalmic surgery. *New York State J. Med.*, 1947, v. 47, Jan., pp. 143-150.

The author discusses the conditions in which an emergency enucleation of the globe is indicated, indications for implantation into Tenon's capsule, emergency problems as are found in congenital, infantile, and adult glaucoma, central venous thrombosis, injuries and magnetic and nonmagnetic

foreign bodies within the eye and orbit; sympathetic ophthalmia, traumatic cataract and dislocated crystalline lens, emergency surgery of the lids and adnexa, neuromyolytic keratitis, keratitis with lagophthalmus, and expanding lesions in the orbit.

Bennett W. Muir

Klein, M. Surgical anatomy of the facial nerve. With reference to the technique of orbicularis block (palpebral akinesia). *Brit. Jour. Ophth.*, 1946, v. 30, Nov., pp. 668-675.

Klein describes the methods of akinesia as suggested by Van Lint and by O'Brien and decides that the chance of error with each is too great. By anatomical dissection he demonstrates that the main bifurcation of the trunk of the facial nerve is quite below the area used so that both methods can easily miss many of the fibers. It is suggested that the correct point for injection is the area below the condyloid process at the junction of the upper and middle third of the distance between the zygomatic arch and the angle of the mandible. (4 figures.)

Morris Kaplan.

Krasnov, M. L. The use of tecodine in ophthalmology. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 35-36.

The authors comments favorably on the use of tecodine, which is dihydroxydionin chlorhydrate, as a substitute for morphine. In ophthalmology it can be used as an analgesic and as a basal anesthetic in conjunction with local anesthesia. It is free from some of the disagreeable effects of morphine, and is much less habit forming.

Ray K. Daily.

Larsson, Sven. Surgical bone-free roentgenography of the eyeball. *Acta Ophth.*, 1941, v. 19, pt. 1, pp. 1-10.

This method is similar to the one proposed by Franceschetti in 1934. The medial surface of the eyeball is exposed through a conjunctival incision, and the rectus internus is separated from the eyeball, the film applied to the surface of the eyeball as far back as the posterior pole, and the X rays directed from the temporal side. For exact localization of nonmagnetic foreign bodies, the film is applied as close to the suspected site of the foreign body as possible, and two exposures are taken. As an indicator the author uses a fine needle point introduced into the episclera. If the X-ray film shows that the foreign body is located at a distance from the indicator, the indicator is removed, reintroduced at another spot, and another X-ray picture taken; this is repeated until the indicator is found to lie exactly over the foreign body. In this fashion the author succeeded in extracting two nonmagnetic foreign bodies from eyes with opaque lenses. This method of localization is particularly suitable for fine nonmagnetic splinters that lie close to the posterior pole. (4 illustrations.)

Ray K. Daily.

Mata, Pedro. Vitamin P in ophthalmology. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Dec., pp. 1256-1265.

Mata reviews the known data on vitamin P and advocates its use as an antihemorrhagic agent. He found it very effective in preventing postoperative hemorrhage after dacryocystorhinostomies, and because of its effect on capillary permeability it exerts a favorable effect in the various types of iritis.

Ray K. Daily.

O'Brien, C. S. Ocular surgery. *Arch. of Ophth.*, 1947, v. 37, Jan., pp. 1-7.

No excuse exists for poor anesthesia.

An apprehensive and uncooperative patient is not conducive to good surgical performance. Preoperative sedation is indicated in all patients. Paralysis of the muscles of lid closure is indicated in any operation in which the globe is opened. O'Brien injects typhoid H antigen vaccine intravenously, in a dose of 10,000,000 to 15,000,000 bacilli, two days before cataract extraction and in a dose of 15,000,000 to 20,000,000 on the next day. A slightly modified Stallard suture is satisfactory. The keratome and scissors incision is much more easily made and is safer than the full Graefe knife incision, although it is less spectacular. Air injected into the anterior chamber keeps the angle open. One eye only need have a dressing. The patient may be allowed to sit in a chair or lie in bed, as desired.

In cataract combined with primary glaucoma the author uses a combined anterior sclerectomy (Lagrange) and cataract extraction. In acute narrow angle glaucoma a basal iridectomy is indicated. In chronic wide or narrow angle glaucoma, in which the tension is not too greatly elevated, in eyes with small visual fields, or as a second operation, cyclodialysis is good practice.

It seems wise to do a two-stage operation in cases of convergent strabismus, for with this method there are few overcorrections. Undercorrection is expected after the first operation. In most cases of convergent strabismus of over 15 degrees a recession of 5 mm. is made on one internal rectus muscle. After three or more months the lateral rectus is shortened, or shortened and advanced, depending on the amount of deviation that remains. In recession a muscle clamp is never used, since 2 to 3 mm. of muscle is lost. Only a squint hook is used, and the sutures are placed as close to the insertion of

the muscle as possible. The muscle sheath is always kept intact.

For tumors of the orbit, a wide lateral canthotomy, extending about one centimeter back from the bony orbital margin, is made, and the incision is extended upward or downward in the conjunctival fornix.

R. W. Danielson.

Paltzeva, T. A. Subconjunctival injections of laked blood in the treatment of corneal diseases. *Vestnik Oft.*, 1946, v. 25, pt. 4, pp. 34-36.

Three drops of the patient's blood are added to one half c.c. of distilled water and when the blood is hemolyzed 0.2 c.c. of the mixture is injected subconjunctivally close to the limbus. The tabulated data show that the treatment has no objectionable features, that it ameliorates discomfort, and stimulates epithelization, vascularization, and absorption of hypopyon. It is effective in superficial herpetic keratitis, and mild corneal ulcers. The general reaction to this treatment consists in an increased number of leucocytes and erythrocytes.

Ray K. Daily.

Piatigorsky, I. V. and Ulskaja, L. D. Ultraviolet erythema in the treatment of traumatic iridocyclitis. *Vestnik Oft.*, 1946, v. 25, pt. 4, pp. 33-34.

In 30 cases of torpid traumatic iridocyclitis, the value of this form of physiotherapy was demonstrated statistically.

Ray K. Daily.

Post, M. H., Jr. Dust-borne infection in ophthalmic surgery. *Trans. Amer. Ophth. Soc.*, 1945, v. 43, pp. 79-97.

The author presents ample bacteriologic evidence of gross contamination of operating fields, solutions, and instruments during the course of routine ophthalmic surgery. His experiments

indicate that 1 to 3,000 zephiran solution is an effective inhibitor of bacterial metabolism and should be substituted for the water bath in which sterile instruments are rinsed. All solutions, towels, and instruments should be kept covered. Instruments that are to enter the eyeball should be dipped into a suitable sterilizing solution or boiling water for at least two and one half seconds immediately before use. Blankets and sheets should be treated with a preparation of an oil and a preparation should be used on the floor to allay the dust. Equipment for sterilization of air is now available and should be installed in operating rooms as soon as possible.

C. D. F. Jensen.

Samoilov, A. J. The mechanism of action of calcium iontophoresis on the eye. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 45-50.

After administering calcium iontophoresis through the lids, through the cornea, and over the skin of the shoulder, Samoilov concludes that calcium acts directly on the tissues of the eye, and not reflexly through the receptors of the skin. The criterion for the action of calcium was diminution of an enlarged blind spot or scotoma following the procedure. While chemically no increase in the calcium content of the eye can be demonstrated, Samoilov believes that the biologic evidence is adequate to prove the direct action of calcium on the edematous ocular tissue. (2 tables.)

Ray K. Daily.

Sená, J. A. Gonioscopy. Introduction to its study. *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Jan.-March, p. 1.

The author discusses the different techniques for the clinical examination of the angle of the anterior chamber,

and describes the normal histology of this region in man. He follows Uribe Troncoso's and Castroviejo's procedures, using the slit lamp and the corneal microscope. The structures of the angle are illustrated in colored drawings and photomicrographs, as well as actual photographs taken with the gonioscope. (Bibliography).

Plinio Montalván.

Shatilova, T. A. Treatment of ocular tuberculosis with anatumerculin. *Vestnik Oft.*, 1946, v. 25, pt. 6, pp. 28-31.

Anatumerculin is an albumin-free preparation manufactured in Leningrad, which Shatilova finds free from the toxicity of old tuberculin. It has no contraindications, and in severe forms should be used in conjunction with general and local therapy.

Ray K. Daily.

Sysi, R. Molluscum contagiosum of the cornea. *Acta Ophth.*, 1941, v. 19, pt. 1, pp. 25-27.

The author believes that he is reporting the first case of molluscum contagiosum of the cornea. The three-year-old boy had two nodules on the border of the left lower lid and one in the center of the right cornea. The microscopic examination and the clinical course verified the diagnosis.

Ray K. Daily.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Aquilar Muñoz, Jose. The use of Remy's diploscope in refraction. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Sept., pp. 878-900.

Since 1940 the author routinely uses Remy's diploscope. It is a simple apparatus and easy to use. It should be used preferably for hypermetropia and

patients with imperfect or absolute faults of binocular vision, and for the diagnosis and treatment of the heterophorias, especially the exophorias. By using this instrument the prescription of prisms becomes more accurate.

J. Wesley McKinney.

v. Bahr, Gunnar. Investigations into the spherical and chromatic aberration of the eye, and their influence on refraction. *Acta Ophth.*, 1945, v. 23, pt. 1, pp. 1-47.

The literature is briefly reviewed, and the author's investigation, using an aberrometer constructed on Scheiner's principle, is reported in detail. The investigation was made in two series: in one, 32 medical students and doctors were tested with red and blue rays, transmitted through a cobalt filter; in the second series, 25 subjects were examined with monochromatic light from a monochromator. The data furnished by these tests were then compared with data derived from refractions, according to Donders, using the same monochromatic illumination on test charts. The tabulated data show that there is, as a rule, positive aberration in the whole of the pupillary field, but that it varies considerably in strength; not infrequently, the aberration is negative, and sometimes it is positive in the central part of the field, and negative in the peripheral part. When the vision is clearest, neither the cusp of the caustic surface nor the narrowest cross section of the refracted pencil of rays is placed on the retina; a cross-section of the caustic surface is situated on the retina, which is nearer to the refracting system than the cusp, when there is positive aberration, and further away when the aberration is negative. The data also show that the total astigmatism as found in the customary re-

fraction tests depends not only on the distance between the points where the paraxial rays intersect in the principal sections, but also on the aberration of the astigmatism. The table of chromatic aberration shows that there is no significant difference between the chromatic aberrations in the different peripheral parts of the optic system, and that in monochromatic illumination the wave length of the light affects refraction considerably. The visual acuity in pure blue light is decidedly lower than in red and green light. (3 figures, 9 tables.)
Louis Daily, Jr.

Burian, H. M. Sensorial retinal relationship in concomitant strabismus. *Arch. of Ophth.*, 1947, v. 37, March, pp. 336-368.

The author describes and analyzes in great detail the sensorial-retinal relationship in concomitant strabismus. The analysis will be continued in a future issue of the Archives.

R. W. Danielson.

Hallett, J. W. Unexplained amblyopia as a military problem. *Military Surg.*, 1946, v. 99, Aug., pp. 110-116.

These studies of bilateral as well as unilateral visual defects included only patients with no visible abnormalities in the eye. Obviously those with strabismus and anisometropia were not included. Malingering, an important feature of the investigation, was determined by the visual angle test. The vision, in the patients studied, was not better than 20/40.

Fifty-one cases were reported, thirty of bilateral amblyopia. Half of the patients with bilateral defects gave positive malingering tests but only two who had unilateral amblyopia malingered. Almost 75 percent of the patients had visual field defects such as tubular

fields, interlacing of color fields, and concentric contraction. Malingerers with bilateral amblyopia were considered as potential psychiatric problems. Tubular fields were associated with functional nervous disorders in a high percentage of cases.

Francis M. Crage.

Hardy, L. H., Rand, G., and Rittler, M. C. Effect of quality of illumination on the results of the Ishihara test. *Arch. of Ophth.*, 1946, v. 36, Dec., pp. 685-699.

Color vision determinations were made on 22 subjects employing various editions of the Ishihara test under standard daylight illumination and also with tungsten filament illumination. The daylight was provided by a Macbeth daylight lamp designed to operate at approximately 6,750° K. The tungsten filament illumination had a color temperature of approximately 2,848° K. When tungsten light is used as the illuminant, the performance scores attained by all of the deuteranomalous and deuteranopic subjects tested are higher than when daylight is used. The responses of protanopic and protanomalous subjects are little affected by this change. A substantial number of deuteranomalous subjects are sufficiently aided in giving normal responses by the incorrect use of tungsten light that they may be erroneously classified as normal. There is a decrease in the number of subjects who are correctly classified as to type of defective red-green vision when tested under tungsten light, as compared with the number so classified when tested under daylight, and an increase in the number of protanomalous and protanopic subjects who are incorrectly classified.

The authors stress the critical importance of strict observance of correct conditions of illumination during the

administration of polychromatic tests which employ test material seen by reflected light.

John C. Long.

Litinsky, G. A. Training of depth perception in the one-eyed. *Vestnik Oft.*, 1946, v. 25, pt. 4, pp. 11-15.

Litinski holds that monocular depth perception is possible if the observer can see the extent of the surface on which the objects are placed; with the surface invisible monocular depth judgment becomes 10 to 20 times poorer than binocular. Binocular depth perception is equally good with or without visibility of the surface. Litinsky agrees with Helmholtz that depth perception is an acquired function and believes that monocular perception can be acquired by training. On the basis of experience with 28 patients, Litinsky concludes that depth perception lost with the loss of one eye can be restored by training, and that best results in training are obtained in people with normal visual acuity. Training is most effective when exercises are done with objects that cannot be related to a visible surface such as ball playing, tennis, ping-pong, volley ball, and basket ball. The period of training requires not less than 10 to 15 days and 15-20 minutes daily. The vocational importance of depth perception justifies the establishment of training facilities in military and civilian hospitals.

Ray K. Daily.

Ludvigh, Elek. Bench for the teaching of ophthalmic optics. *Arch. of Ophth.*, 1947, v. 37, March, pp. 383-385.

The optical bench is an essential adjunct to laboratory instruction in elementary ophthalmic optics. The benches ordinarily employed are not designed for the teaching of ophthalmic

optics and have many features which are undesirable for that purpose. Ludwig points out the difficulties experienced with the optical benches commonly available, and states how these are overcome in the bench here described.

R. W. Danielson.

Moore, R. F. Subjective "lightning streaks." *Brit. Jour. Ophth.*, 1947, v. 31, Jan., pp. 46-50.

Three oculists describe their subjective experiences with "lightning streaks." These streaks apparently occur after middle age, most usually in myopic eyes and perhaps more commonly in women. Sudden flashes of light occur along with the simultaneous appearance of spots before the eyes. They are very bright, occur in the outer fields mostly and move from above downward. They start in one eye but tend to become bilateral. They are associated with quick movements of the eyes and thus can be elicited at will. They are best seen at night and the eyes may be open or closed. Verhoeff, one of the subjects, attributes them to a shrinking and partial separation of the vitreous which then impinges on the retina and induces the stimulation.

Morris Kaplan.

Valerio, Mario. Jackson's cross cylinder in the determination of the axis of astigmatism. *Rassegna Ital. d'Ottal.*, 1946, v. 15, July-Aug., pp. 241-263.

Valerio reviews the history of the bicylindric lenses from the time of Stokes, in 1849, until its perfection by Jackson. The author considers the correct name to be bicylinders, rather than cross cylinders. In spite of its wide use in the United States the instrument is little known abroad. The author soon found the cross cylinder "absolutely indispensable for an accurate examina-

tion of the refraction" and proceeds to give a complete explanation of its construction and application, with illustrative cases and photographs. (4 figures.)

Eugene M. Blake.

Walker, J. P. S. Myopia and pseudomyopia. *Brit. Jour. Ophth.*, 1946, v. 30, Dec., pp 735-742.

Walker points out that many cases of pseudomyopia are missed in routine practice. It occurs mostly in the young, but it can occur at any age. As a safeguard the author suggests that all patients under 16 years of age be refracted after atropine has been instilled twice daily for three days. In some cases it should be instilled for two weeks before examination. The term pseudomyopia includes spasm of accommodation. Ten reports are presented of cases in which the patient seemed to desire more minus power than the refraction indicated; these were considered as due to spasms and were treated with atropine or orthoptic training or both with very good results. The fact is emphasized that pseudomyopia is just as likely to occur in the hyperopic and emmetropic patients as in myopic ones.

Morris Kaplan.

Weekers, R., and Roussel, F. Introduction to study of the critical flicker frequency for clinical purposes. *Ophthalmologica*, 1946, v. 112, Dec., pp. 305-319.

Critical flicker frequency or fusion frequency of flicker is the smallest number of periodic changes from light to dark per second which abolishes the subjective sensation of flicker. The authors have constructed an apparatus for the determination of the critical flicker frequency of circumscribed, central or peripheral retinal areas and have found parallelism, in diseased eyes, be-

tween the results of quantitative perimetry and the critical flicker frequency.

Peter C. Kronfeld.

4

OCULAR MOVEMENTS

Adler, Francis H. **Physiologic factors in differential diagnosis of paralysis of superior rectus and superior oblique muscles.** *Arch. of Ophth.*, 1946, v. 36, Dec., pp. 661-673.

In cases of primary or congenital paralysis of a vertically acting muscle a differential diagnosis between paralysis of the superior oblique of one side and the superior rectus of the opposite side may be made on the basis of the following signs: Tilting the head is the most characteristic sign of paralysis of the superior oblique muscle. Tilting does occur with paralysis of the superior rectus, but is slight. The head is always tilted toward the side opposite the paralyzed eye. If the head is tilted by the examiner on the shoulder of the same side as the paralyzed eye, this eye will make an upward movement if the superior oblique is paralyzed. If the superior rectus is paralyzed, the eye either will not move at all or will move slightly downward.

A factor which may confuse the picture in primary or secondary paralysis of a vertically acting muscle is the occurrence of inhibitional palsy of the contralateral antagonist. When this is present, primary paralysis of the superior oblique may easily be mistaken for paralysis of the superior rectus. The physiologic bases for the various signs are discussed in some detail.

John C. Long.

Azzolini, Umberto. **Synkinesis between the levator palpebrae superioris and the musculus zygomaticus.** *Riv.*

Oto-Neuro-Oft., 1942, v. 19, Nov.-Dec., pp. 382-397.

An otherwise normal girl, eight years of age, had an almost complete left ptosis; the upper lid could not be elevated by any of the synkinetic innervations except in smiling. The homolateral zygomatic muscle is innervated by the seventh cranial nerve. The author assumes that there was a congenital heterotopic location of the nucleus of the levator palpebrae superioris, the cells of which were displaced into the neighborhood of the nucleus of the facial nerve. (4 figures.)

K. W. Ascher.

Cass, E. **Strabismus.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Feb., pp. 126-160.

The author presents a detailed review of the literature concerning strabismus, especially from the etiological standpoint. (10 illustrations.)

J. Wesley McKinney.

Del Barrio, Alejandro. **Development and treatment of squint.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Sept., pp. 863-877.

The author agrees that the key to the development of squint is in the binocular vision, which if it develops normally produces no squint, even if there are other disposing causes. On the other hand, if this function is incomplete, a small alteration of the optic apparatus, sensorial or motor, is able to produce squint. It is thus that surgical as well as functional treatment is directed toward normalizing the binocular vision.

J. Wesley McKinney.

Della Vedova, Ausano. **Laryngo-vestibular signs in syringobulbia.** *Riv. Oto-Neuro-Oft.*, 1943, v. 20, Jan.-Feb., pp. 29-39.

In three patients suffering from syringobulbia, spontaneous nystagmus was associated with laryngeal paresis. In two of them, the nystagmus was rotatory, counterclockwise, and associated with a right abduction paralysis of the larynx; in the third the laryngeal paresis was bilateral, and the nystagmus horizontal. This syndrome is of diagnostic significance in early stages of syringobulbia. K. W. Ascher.

Epstein, G. J. Congenital vertical motor pareses. *Arch. of Ophth.*, 1947, v. 37, March, pp. 369-374.

After discussion of the literature and a review of pertinent embryology, the authors conclude that congenital pareses of the extrinsic ocular muscles are due to errors in cleavage of the common premuscle mass, aplasia of the primitive head cavities and aplasia of the connections in the central nervous system. Of these, pareses of the first type are by far the most common.

Errors in cleavage are most likely to affect those muscles which are differentiated late in embryonic development. Therefore, of the vertical muscles, the superior rectus is by far the most commonly affected, the inferior rectus and the inferior oblique next and the superior oblique most infrequently. There is clinical evidence to support this view.

R. W. Danielson.

Ferrara, Aristide. A case of Parinaud's paralysis. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, July-Aug., pp. 277-288.

Two years before admission, a 40-year-old farmer had become unconscious and had suffered a paralysis of his left arm, and diplopia. Corrected vision was 10/10 and 7/10 respectively; the visual fields were normal. Ophthalmoscopy revealed no pathologic changes. The eyeballs could be rotated

neither up nor down, and no convergence was possible; touching of the corneas produced contraction of the orbicularis but no flight movement of the bulbi. Compensatory eye movements were absent. The Wassermann reaction in the cerebrospinal fluid was positive. A luetic arteritis of the cerebral arteries was assumed and a juxtaventricular hemorrhage seemed to be responsible for the lesion involving the nuclei that govern the associated eye movements.

K. W. Ascher.

Ferreira Filho, J. Pseudo-Graefe phenomenon. *Arch. of Ophth.*, 1947, v. 37, March, pp. 308-317.

The author reviews the literature and reports a case of his own.

R. W. Danielson.

Fisher, E. M. The practical significance of the voluntary convergence. *Vestnik Oft.*, 1946, v. 25, pt. 4, pp. 10-11.

Whereas the role of the accommodation-convergence relationship in the pathogenesis of convergent strabismus is well understood, its role in straightening the visual axes in divergent strabismus is sometimes overlooked. In the effort to obtain parallelism of divergent eyes the exercise of convergence produces a spurious myopia, the nature of which can be established by skiascopic examination under atropine, and which should not be corrected with glasses.

Ray K. Daily.

Fisher, E. M. Errors in the conservative treatment of strabismus. *Vestnik Oft.*, 1946, v. 25, pt. 4, pp. 6-9.

Listed as errors in the pattern of therapy of concomitant strabismus are improper selection of patients for delayed treatment, failure to prescribe the full correction, neglect to treat amblyopia, or to treat it inadequately, inade-

quate preparation for orthoptic training by preliminary refraction, the training of binocular vision in the presence of abnormal correspondence, and orthoptic training in the presence of a large angle of deviation of the visual axes.

Ray K. Daily.

Krewson, William E., III. Surgical methods of treating paralysis of the superior oblique muscle. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 121-133.

No one standard sequence of corrective measures can be advocated for all patients. The plan of attack must be based on the measurements in the individual case. If a choice is permitted, weakening of a depressor muscle is undesirable; strengthening of a depressor or weakening of an elevator muscle is preferable, for there is greater need for binocular vision in the lower than in the upper parts of the fields. If there is marked overaction of the homolateral, antagonistic inferior oblique muscle, tenotomy of this muscle is probably desirable as the initial operation. In the usual case of paralysis of the superior oblique muscle most surgeons apparently first do a recession of the contralateral inferior rectus and then attempt a shortening of the paralytic superior oblique. Depending on measurements then obtained, these operations are supplemented by recession of the homolateral, overacting inferior oblique, advancement of the contralateral superior rectus or advancement of the homolateral inferior rectus. In cases of bilateral paralysis of the superior oblique, equalization and preservation of the remaining depressors are advisable.

John C. Long.

Lewis, M. M. An investigation of "normal" on the synoptophore. *Brit. Jour. Ophth.*, 1946, v. 30, Dec., pp. 749-757.

An interesting statistical study on 100 young subjects who had no ocular complaints is presented. The study was performed to determine a normal for synoptophore measurements and to compare these with Maddox rod measurements. The subjects were tested for binocular vision, fusion, abduction and adduction and the data are tabulated. There was some correlation between Maddox rod readings and those of the synoptophore though the latter readings were generally more exophoric and spread over a wider range.

Morris Kaplan.

Lopez-Dominguez, B. A classification of strabismus and its therapeutic implications. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Dec., pp. 1277-1283.

The proposed classification is based on disturbances of the function of each of the participating entities of the reflex act of seeing, namely, the organ of perception, the centripetal pathway, the center, the centrifugal pathway, and the motor apparatus. Refractive strabismus, which is divided into isometropic and anisometropic, may be caused by a disturbance in the eye itself and may be central in origin. The instability of the surgical results is attributed to the fact that frequently the surgical procedure has no relation to the etiologic factor, and it is pointed out that the prognosis is best in cases in which the deviation is due to refractive or muscular anomalies, amenable to direct correction.

Ray K. Daily.

Matteucci, P. Congenital defects of abduction. *Rassegna Ital. d'Ottal.*, 1946, v. 15, Sept.-Oct., pp. 345-380.

Deficiency or congenital absence of abduction is frequently associated with numerous other defects, especially with

paralysis of the third and seventh cranial nerves. At times malformations of the eyes, the face, the trunk or the extremities, and retraction of the globe are noted. Among 60 cases collected from the literature other disturbances of motility than defects of abduction were found 25 times, anomalies or malformations were reported 14 times, and retraction of the globe 23 times. Three cases are added by the author, and a histologic study made of one of them is given in detail. The literature is extensively reviewed. (2 tables, 6 figures.)

Eugene M. Blake.

Milietti, Mario. Contribution to the knowledge of multiple aneurisms of cerebral vessels. *Riv. Oto-Neuro-Oft.*, 1946, v. 21, May-Aug., pp. 141-152.

A woman, 54 years of age, had recurrent attacks of pain of the left eyeball and the region about it for about a year. She had complete left oculomotor paralysis, and a slight right hemiparesis. Cerebral arteriography showed a diffuse cerebral arteriosclerosis, a big aneurysmal enlargement of the left internal carotid artery and a smaller aneurysmal sac of the posterior communicating artery above the posterior clinoid. In his discussion the writer states that the paralytic symptoms were due to compression of the trunk of the third nerve by the posterior aneurysm, and the hemiparesis to the compression of the pes pedunculi. The writer calls this symptomatology a "syndrome of the aneurysm of the pes pedunculi region." (Bibliography and 2 figures.)

Melchior Lombardo.

Ogle, K. N., and Ellerbrock, V. J. Cyclofusional movements. *Arch. of Ophth.*, 1946, v. 36, Dec., pp. 700-735.

There is now agreement that the external muscles of the eyes can, in the

interest of maintaining binocular single vision, cooperate to provide cyclotorsions about the visual axes, which themselves may remain fixed. These movements have been designated as psychooptical reflex movements.

The authors discuss experiments utilizing stereoscopic methods of spatial localization, which show that these cyclofusional movements occur much more freely than was heretofore realized. In the main these movements take place with any change in the type and orientation of configurations in the visual field.

A statistical study of the data obtained from 400 subjects with astigmatism at oblique axes is presented. The results suggest that the eyes of these subjects maintain cyclotorsional positions that partially correct the declinations of the images which, in turn, arise from the meridional magnifications accompanying the correction of the astigmatic errors.

The correlation found emphasizes the stability of the organization between the retinal elements of the two eyes.

John C. Long

Rogers, Lambert. A curious reflex movement of the upper eyelid in oculomotor palsy. *J. Royal Naval Med. Service*, 1946, v. 32, Oct., pp. 270-272.

The author describes a case of ptosis of the right upper eyelid following an intracranial aneurysm. When the left eye is turned outward, the ptosed right upper lid opens; as the left eye continues outward, the right upper lid continues to open until the left eye is maximally abducted and there is almost complete opening of the right eye. The lid movement is reflex and involuntary. (4 figures.)

Irwin E. Gaynon.

Scobee, R. G., and Green, E. L. Tests for heterophoria. *Amer. Jour. Ophth.*,

1947, v. 30, April, pp. 436-451. (8 tables, 9 references.)

Sergievsky, L. I. **Invisible strabismus, and the character of vision with both eyes open.** *Vestnik Oft.*, 1946, v. 25, pt. 4, pp. 4-5.

This is an analysis of 983 cases of strabismus; 62 cases with no deviation of the visual axis and no binocular vision are designated as invisible strabismus. Among 102 patients with periodic strabismus, vision not lower than 0.5 in the poorer eye was found in 23, binocular vision was present in 16, and simultaneous macular perception was present in 20 patients, of whom 10 had good vision. Of 98 patients in whom the visible strabismus became invisible, 42 developed binocular vision, 51 had monocular vision, and 5 had simultaneous perception. The data thus show that deviation of the visual axes may disappear with age, but the absence of binocular vision remains; the time required for parallelism of the visual axis to develop with glasses is 1 to 18 months; in half of the patients it was two to four months. With orthoptic treatment patients with monocular vision develop simultaneous macular perception in 12 to 14 days, but it may take 11 months; simultaneous perception develops into binocular vision in four to 10 months. When the deviation did not disappear under atropine, but did clear up after wearing of glasses, it required two months to develop simultaneous perception, and one to three months longer for the development of binocular vision.

Ray K. Daily.

Sergievsky, L. I., and Bilit, M. V. **The effect of prolonged atropinization on the refraction and on the angle of deviation in concomitant strabismus.**

Vestnik Oft., 1946, v. 25, pt. 4, pp. 15-17.

An analysis of their case histories shows that the attainment of complete paralysis of accommodation requires at least ten days of atropinization, and that failure of the visual axes to become parallel even after atropinization for ten days is not conclusive evidence that the wearing of glasses will fail to straighten the eyes. Atropine is apt to correct deviations of 20 degrees. An interesting feature is exhibited by two hypermetropic patients in whom atropinization produced no change in the refractive correction, but relieved a deviation of the visual axes of 20 and 10 degrees respectively. Among those in whom the eyes became straight are some in which the deviating eyes had a visual acuity of .01. There was obviously no stimulus for accommodation in such eyes; the important factor in the deviation and the straightening of the visual axes seems to be the accommodation of the fixating eye.

Ray K. Daily.

Strich, A. J. **Classification of strabismus.** *Illinois Med. J.*, 1946, v. 89, Jan., pp. 25-28.

The author classifies strabismus, on an etiologic basis, as anatomic and innervational. In the former a lesion in the motor apparatus of the eye can be demonstrated, and in the latter, no lesion in the motor apparatus can be proved, although there may be a lesion of the visual apparatus, or a disease of the central nervous system. The anatomic cause may be a difference in shape of the two orbits, a congenital or acquired abnormality of the external ocular muscles or injuries to the peripheral neuron of the third, fourth, and sixth cranial nerves (as in diph-

theria, Gradenigo's syndrome, lues, tuberculosis, and meningitis). Nuclear strabismus is caused by congenital aplasia, hemorrhage, infections, diabetes, and poisoning of the nucleus of the nerves, and supranuclear strabismus can be caused by encephalitis lethargica, multiple sclerosis, small hemorrhages, and tumors that involve supranuclear pathways. A discussion of the diagnosis of supranuclear lesions follows. Corpus striatum strabismus is usually caused by postencephalitic Parkinson's disease, paralysis agitans, or Wilson's disease.

Innervational factors frequently complicate anatomic strabismus or may be the only cause as in the Donder's type in which an excessive hyperopia brings about excessive accommodation. Convergent squint associated with congenital myopia is probably due to a conditioned reflex. Inasmuch as the patient can see objects only when held very close, he develops an association between vision and excessive convergence. Poor-vision squints develop exotropia if the poor vision is present at birth, esotropia if it comes on during the period of flux. Pseudoparalytic strabismus is an alternating convergent strabismus, simulating bilateral abducens paralysis. The patient alternately uses his left eye to see the right part of the field, and his right eye to see the left part, and thus never has use of the external rectus muscles. Associated vertical divergence is caused by intermittent excitations of the vertical divergence center. Overaction of the inferior obliques is synkinetic in origin. Excessive stimuli to the convergence center overflow to the adjacent center for action of the inferior obliques, thus causing unilateral or bilateral primary inferior oblique spasms. Most strabis-

mus has a combination of anatomic causes and innervational factors.

John B. Hitz.

Tassman, I. S. Complete unilateral ophthalmoplegia due to primary carcinoma of the sphenoidal sinus. *Arch of Ophth.*, 1946, v. 37, March, pp. 294-303.

A neoplastic, inflammatory, or traumatic process which involves the structures passing through the sphenoidal (superior orbital) fissure and the optic canal may result in pressure on these structures and cause an ophthalmoplegia. The condition has been described in the literature as the "orbital apex-sphenoid fissure syndrome." About 10 cases of the syndrome have been reported in the American literature since 1900.

Carcinoma of the sphenoidal sinus has five routes of extension. In order of frequency, these are: orbital, nasal, cranial, petrous and occipital.

An interesting case of the complete syndrome is reported which was due to lateral extension of a malignant process from the sphenoidal sinus that involved the structures which leave the adjacent cavernous sinus and enter the sphenoidal fissure and the optic canal.

Epistaxis was unusually severe and prominent. Together with headache, it was an initial symptom. Severe, sharp, knifelike pains radiated over the forehead, the right temple and both eyebrows, and were more severe over the right side. There was also a burning sensation of the scalp.

The ophthalmoplegia came on rather quickly. It was complete within six days after appearance of the first ocular signs. In most of the cases in which the syndrome is due to a malignant growth, the symptoms have a much

slower onset and are more gradual in their progress.

Since this case was reported, the author has had the opportunity to study two others. R. W. Danielson.

5

CONJUNCTIVA

Abkina, D. A., and Normark, I. P. Conjunctival erythema in typhus. *Vestnik Oft.*, 1945, v. 25, pt. 4, pp. 45-46.

Bluish-red oval spots in the conjunctiva about 2 mm. in size are diagnostic of typhus fever; they may precede the rash, and persist after the rash has disappeared. Microscopically these spots show a stasis in the arteriocapillary network immediately under the epithelium, proliferative perivascularitis, and hemorrhages. Among 45 patients with typhus 12 had conjunctival erythema. Ray K. Daily.

Arcuri, Domenico. Conjunctival naevi. *Rassegna Ital. d'Ottal.*, 1946, v. 15, July-Aug., pp. 264-289.

The author asserts that the majority of malignant epibulbar tumors arise from naevi, and stresses the importance of biomicroscopic study of all such cases. By this method the delicate changes of initial malignant degeneration can be detected. The histologic changes are described and the disputed question whether they arise from epithelial or connective tissues is considered. Arcuri reports two cases and found it impossible to determine their origin microscopically. Every naevus which shows a tendency to increase in size should be excised and the removal followed by diathermy coagulation. (6 figures.) Eugene M. Blake.

Bruce, G. M., and Locatcher-Khorazo, D. Primary tuberculosis of the

conjunctiva. *Arch. of Ophth.*, 1947, v. 37, March, pp. 375-378.

A case of primary tuberculosis of the conjunctiva with involvement of the adjacent lymph nodes in a 9-year-old child is reported. Systemic extension did not take place, and the patient recovered under conservative treatment.

R. W. Danielson.

Chulia, Vincennte. Actinic keratoconjunctivitis. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Dec., pp. 1253-1254.

A case of actinic keratoconjunctivitis in a 15 year old girl, with pale, fine skin, and red hair, is reported, and it is pointed out that a constitutional predisposition is an essential factor for the development of this disease.

Ray K. Daily.

Frouchtman, R. A case of spring catarrh caused by light. The favorable effect of antergan. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Dec., pp. 1247-1253.

A case of spring catarrh in which light was the principal active irritant is reported because of two interesting features. Porphyrinuria, negative pollen tests, and a history of liver disturbances in the maternal family justify the assumption that the photosensitivity was due to a hepatogenic disturbance in the porphyrin metabolism. The second point of interest is the quick therapeutic response to antergan, a synthetic antihistaminic.

Ray K. Daily.

Mairlot Nieto, Roberto. Treatment of gonococcal conjunctivitis neonatorum. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Feb., pp. 209-210.

The author has had good results in

treating patients with gonococcal conjunctivitis neonatorum locally with 30-percent solution of sodium sulfacetamide (Albucid). The instillations were given every half hour, day and night, for the first 48 hours, and every one or two hours on the following days. At the same time the eyes were washed with normal saline solution at frequent intervals. J. Wesley McKinney.

Poliak, B. L., and Gerasimenko, T. N. Epidemiology, clinical course, and sulfa therapy of gonoblenorrhea. *Vestnik Oft.*, 1946, v. 25, pt. 4, pp. 26-30.

The material comprises 42 patients with gonoblenorrhea, which was bilateral in 36. In 17 the cornea was involved, and in 11 it had perforating ulcers. No patient was admitted to the hospital earlier than four days after onset of the disease. Treatment consisted in insufflation of powder into the conjunctival sac and intramuscular or intravenous injections of the drug. The tabulated data show that intramuscular injections in children were as effective as intravenous injections in adults, and that the results following this form of therapy are better than those obtained by oral administration. Uncomplicated gonorrheal conjunctivitis is cured in this manner in five to seven days. No corneal complications ever developed after the administration of the drug began. The progress of infiltrates was arrested and the ulcers rapidly became clean. The sulfa drug frees the eye of infection, and at the same time inhibits epithelial growth. The rapidity with which the conjunctival sac becomes free of gonococci eliminates the danger of involvement of the second eye. Ray K. Daily.

Stern, H. J. Sulphapyridine-resistant Koch-Weeks conjunctivitis. *Brit. Jour.*

Ophth., 1946, v. 30, Dec., pp. 722-723.

In the East African Negro troops the author found much virulent conjunctivitis caused by the Koch-Weeks bacillus which did not respond at all to treatment with sulphapyridine.

Morris Kaplan.

Tranou. Treatment of trachoma with sulfonamide. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Dec., pp. 1284-1288.

A controlled clinical investigation of 95 children with palpebral trachoma is reported. The children were divided into groups which were treated by means of oral administration of sulfonamides, oral administration combined with local therapy, local application of sulfonamide ointment alone, and subconjunctival injections of sulfa drug solutions twice weekly for six weeks. Oral administration of sulfa drugs lead to improvement in many cases, but to few cures. Better results were obtained by a combined local therapy with oral administration of the drug. The best results were obtained from subconjunctival injections of irgamid. Sulfathiazole, because of severe reactions, is unsuitable for subconjunctival injections.

Ray K. Daily.

6

CORNEA AND SCLERA

Angius, T. Corneal involvement in Duhring's disease. *Rassegna Ital. d'Ottal.*, 1946, v. 15, July-Aug., pp. 290-297.

Duhring's disease is frequently confused with pemphigus and some writers consider it a form of the latter. The eruption is usually bullous but may be polymorphous and affects the skin of any part of the body. There is an eosinophilia of 10 percent in the blood and 90 percent in the bulla. The disease is

characterized by periods of remission, with a tendency to gradual subsidence. A case is described with ulceration of the cornea, in a 41-year-old man in whom the skin eruption had been present for 2 years. Eugene M. Blake.

Bakker, A. Some researches on the respiration of the cornea in albino rats. *Brit. Jour. Ophth.*, 1947, v. 31, Feb., pp. 100-108.

A description is given of the technique of studying the influence of various concentrations of carbon dioxide and the absence of oxygen in the surrounding atmosphere, on the cornea of anesthetised albino rats. With the help of artificial respiration it was possible to shut the animals in a tank, and to expose the eyes under otherwise normal conditions to the gas under investigation. It could be determined that the so-called selective permeation of carbon dioxide through the cornea is not probable. Absence of oxygen in the surrounding atmosphere does not inhibit normal life of the cornea. The corneas remained transparent for many hours in an atmosphere of 8 percent of carbon dioxide and 92 percent of nitrogen. Special attention was paid to possible pathologic changes in the corneas after the experiments were finished.

O. H. Ellis.

Balcet, C. Various forms of superficial punctate keratitis. *Rassegna Ital. d'Ottal.*, 1942, v. 11, March-April, p. 109.

Twenty-three cases of superficial punctate keratitis are described and from the observation of these, and from the study of the literature, Balcet believes that the name includes the infective form which has been seen often in the tropics. All of the different

forms are herpetic in origin. In tropical and subtropical countries conditions which favor development of the disease are the hot and moist climate, poor hygiene and nutrition, plus a certain avitaminosis.

Eugene M. Blake.

Blanchi, G. Primary adiposis of the cornea. *Rassegna Ital. d'Ottal.*, 1942, v. 11, March-April, p. 144.

The term primary adiposis of the cornea should be reserved for those cases in which no other severe ocular disease exists. It is a true lipoidosis of the cholesterine form, with a demonstrated disequilibrium of fatty metabolism. The cause is to be searched for in hormonal alterations, in the ovary, thyroid and hypophysis. Nor should the importance of the reticuloendothelial system be disregarded.

Two forms of corneal adiposis are recognized, the annular and the central discoid; the second form is considered a part of the annular type.

The literature is well abstracted and one case with histological study is reported. Eugene M. Blake.

Castroviejo, Ramon. Indications and contraindications for keratoplasty and keratectomies. *Trans. Amer. Ophth. Soc.*, 1945, v. 43, pp. 324-330.

The author bases his conclusions on the study of more than 600 keratoplasties and over 100 keratectomies. Keratoplasty gives the better visual acuity. With keratoplasty it is not rare to obtain vision of 20/20 while with keratectomy astigmatism and residual haziness reduce vision to 20/100 or less. In glaucoma, it is usually advisable to make a very large iridectomy to reduce the danger of anterior synechia and the recurrence of glaucoma. Very favorable for keratoplasty are central

opacities where the transplant will remain surrounded by healthy corneal tissue, keratoconus, and interstitial keratitis when the transplant will remain in contact with healthy corneal tissue. A high percentage of clear grafts may be expected with final vision averaging better than 20/50 and not infrequently 20/20. Less favorable for keratoplasty, but still likely to give a high percentage of transparent grafts are corneal dystrophies, superficial corneal opacities, tear gas burns without pannus formation, adherent leukomas, descemetocoeles following corneal ulcers or surgical procedure in or near the pupillary area, and interstitial keratitis with more extensive and denser opacity. Unfavorable for keratoplasty are corneal scars which include the pupillary area and extend to the limbus, extensive leukomas in which the transplant will be surrounded in more than one half of its circumference by dense scar tissue (keratectomy may improve vision or make the eye more favorable to undergo keratoplasty), band-shaped opacity, in which it is preferable to perform a partial superficial keratectomy, dystrophia adiposa, deep corneal burns with tear gas where preliminary superficial keratectomy is indicated, extensive corneal opacities caused by explosions that leave the cornea with a tattooed appearance, corneal opacities in aphakic eyes, extensive corneal opacities with superficial vascularization of the pannus type generally caused by burns, Fuchs's epithelial dystrophy, extensive corneal opacities with calcareous degeneration, corneal opacities caused by pemphigus, corneal opacities with pronounced nystagmus, and corneal opacities with extensive anterior synechiae.

C. D. F. Jensen.

Feigenbaum, A., and Kornblueth, W. Posterior ring abscess of metastatic origin in Behcet's disease. *Brit. Jour. Ophth.*, 1946, v. 30, Dec., pp. 729-734.

Behcet's disease is a constitutional disorder due to sepsis and characterized by aphthous stomatitis, recurrent ulcers, recurrent iridocyclitis, retinitis, optic neuritis, and skin eruptions on the lower extremities. The cause is usually streptococcus aureus.

In the case reported, the eye had a marked posterior ring abscess of the cornea and severe inflammation. The aqueous was cloudy, but no hypopyon was present. Posterior synechiae were numerous and there was a cataract. The tension was elevated. Despite large doses of sulphathiazole and daily paracentesis, the patient became worse and developed general septicemia. One million units of penicillin were given with rapid improvement; the eye, however, went on to phthisis bulbi.

Morris Kaplan.

Henkes, H. E. On the distribution of glutathione and vitamin C in the lens and cornea. *Ophthalmologica*, 1946, v. 112, Sept., pp. 113-128.

The object of the study was to determine the respective concentrations of vitamin C and glutathione in the various layers of lens and cornea. By means of a trephine, cylindrical pieces were removed from frozen corneas and lenses. These pieces were sectioned with the microtome at right angles to their axes. Alternate sections in groups of four were used for the glutathione and vitamin C determinations, which were made by iodine and dichlorophenol-indophenol titration, respectively. Lenses and corneas of cattle, guinea pigs, and rabbits were studied under normal conditions as well as in a state

of experimental scurvy. In the lens the highest concentration of vitamin C was found in the subcapsular layers and of glutathione in the perinuclear layers. In the cornea the subepithelial stroma contained more vitamin C and glutathione than any other layer. Under conditions of experimental scurvy, vitamin C disappeared from the two ocular tissues within 14 to 19 days. The glutathione content remained unchanged.

Peter C. Kronfeld.

Hercus, John. Epidemic keratoconjunctivitis in Australian troops. *M. J. Australia*, 1946, v. 2, Dec. 14, pp. 838-840.

A series of 56 patients with epidemic keratoconjunctivitis is reported. The patients were soldiers, and only one eye was involved in 50 of the patients. All had some form of corneal involvement, either superficial punctate staining or deeper infiltrates. There was a thin, stringy discharge, and in most cases a marked blepharitis. Cultures were negative, and attempts to grow the virus were unsuccessful. Treatment consisted of atropine, penicillin drops (500 Units per c.c.), bandaging of the eye for the first three to four days, and silver nitrate applied to the lids. If blepharitis was marked, 2-percent solution of gentian violet was used on the lid margins. The disease generally disappeared within nine days. The epidemiology was not determined although some association was noted with periods of heavy rainfall.

Benjamin Milder.

Katsnelson, A. B. Ariboflavinosis in ocular diseases. *Vestnik Oft.*, 1946, v. 25, pt. 4, pp. 18-23.

The author's impressions on the

effectiveness of riboflavine in incipient cataract and corneal diseases are sufficiently favorable to stimulate future investigation.

Ray K. Daily.

Katzin, H. M. Contributions to the technic of corneal grafting. *Arch. of Ophth.*, 1947, v. 37, March, pp. 379-382.

Katzin describes his studies in corneal transplantation at the Cornell Research Laboratory. An automatic trephine is used, by which two or three grafts may be obtained from the donor eye.

R. W. Danielson.

Kolenko, A. B. Desensitization therapy of scrofulous keratoconjunctivitis. *Vestnik Oft.*, 1946, v. 25, pt. 6, pp. 34-37.

Kolenko used subcutaneous injections of laktin and, when laktin was no longer available, fat free milk with a satisfactory and permanent result. Tabulated data show improvement in visual acuity with this form of therapy.

Ray K. Daily.

Latorre, S., and Crespi, G. Treatment of herpetic keratitis with alcohol. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Sept., pp. 849-862.

The authors report good results obtained in the treatment of herpetic keratitis with 90 percent alcohol. The procedure is easy and is not dangerous. After instillations of cocaine, fluorescein is used to make the lesion more visible. Now the lesion is touched with the alcohol. The treatment may be repeated every three days until the lesion does not stain. They present 19 cases. In one the treatment failed because there was a secondary infection. (Illustrations.)

J. Wesley McKinney.

Leopold, I. H., and Adler, F. H. Use of frozen-dried cornea as transplant

material. *Arch. of Ophth.*, 1947, v. 37, March, pp. 268-276.

Keratoplasty has reached the stage today at which the demand for donor corneas has exceeded the supply. The small supply is largely due to the difficulty in preserving all available corneal tissue until the time at which it is needed. With the present methods of preservation, corneal tissue held over seventy-two hours is believed to be unsatisfactory for transplantation. The purpose of the experiment was to determine the value of frozen-dried cornea for corneal transplantation, as suggested by the preliminary experiments with rat cornea of Weiss and Taylor.

Fifty-nine of the 75 transplanted frozen-dried corneas healed in the recipient corneas. In 19 of these 59 grafts corneal vascularization occurred. In 6 of the 59 "takes," infection was an outstanding and early complication, and in 9 corneal edema persisted. Of the 16 eyes in which the transplant failed to remain in position, neither lid nor corneal sutures were used in 12.

The authors report that frozen-dried corneal tissue can be transplanted to normal rabbit eyes without an unusual host reaction. However, not one of the 59 "takes" with frozen-dried cornea were transparent at any time during the six months of observation.

R. W. Danielson.

Mann, I. "Blue haloes" in atebtrin workers. *Brit. Jour. Ophth.*, 1947, v. 31, Jan., pp. 40-46.

Six male patients who worked with powdered atebtrin complained of seeing blue haloes around lights at night. They had pursued all ordinary protective measures and showed no dermatologic

evidence of sensitivity. They had no other ocular complaints and vision was normal. On slitlamp examination all presented the same picture. The conjunctiva showed a diffuse pale yellow stain in the interpalpebral space only; at the limbus there were numerous minute dark brown spots. The whole surface of the cornea was covered by very fine yellow-brown particles which were actually imbedded in the cytoplasm of the superficial cells.

Experiments with rabbits showed that the granules were taken up by the cells directly from the surface and not through a systemic route. Once they appeared in the cells they did not dissolve but remained until the cells were normally cast off. The haloes were obviously a diffraction effect due to the opaque granules. The complaints were very mild, and disappeared without sequel in about two months after cessation of exposure.

Morris Kaplan.

Olontzeva, M. V., and Pokrovsky, A. I. Denig's operation and transplantation of preserved tissue by Filatov's method in the treatment of trachomatous pannus. *Vestnik Oft.*, 1946, v. 25, pt. 1, pp. 27-30.

Both operations consist of implantation of a transplant above the cornea parallel to the limbus; they differ in that Denig uses an autoplasmic transplant of fresh tissue and Filatov uses a homoplasmic transplant of preserved tissue. The authors used one procedure in one eye, and the other in the other eye, and selected subjects in whom the process was equally advanced in both eyes. During the occupation of Voronezh by the Germans this study was interrupted and Olontzeva perished.

Four years later, when the invaders were expelled, some of the patients returned and the results of the operations were checked.

The most important common factor is the surgical site above and parallel to the limbus. Implantations in other places on the eyeball gave inferior results. Transplantation of preserved tissue after Filatov has the advantage of more rapid absorption and a more pleasing cosmetic effect, but with this goes the disadvantage of a more rapid termination of the action of biogenic stimulants and the need for a repetition of the procedure. The effect of both procedures is usually temporary. Prolonged existence of severe pannus leaves as a consequence irreversible corneal cicatricial changes, and therapy should be energetic to shorten the course. Both Denig's operation and Filatov's procedure serve to stimulate regenerative processes.

Ray K. Daily.

Paraipan, Constantin. Pneumococcal corneal ulcer healed in 24 hours with penicillin. *Amer. Jour. Ophth.*, 1947, v. 30, April, pp. 475-477. (5 references.)

Rubino, A., and Esente, I. Comparison between experimentally produced signs of ocular ariboflavinosis and those observed in human nutritional deficiency of vitamin B₂. *Riv. di Oftalm.*, 1946, v. 1, July-Aug., pp. 473-488.

This article consists of abstracts from the literature of the last years concerning experimental and nutritional ocular manifestations of riboflavine deficiency, and a few observations on the authors' patients. (Bibliography.)

K. W. Ascher.

Thygeson, P. Marginal corneal infiltrates and ulcers. *Trans. Amer. Acad.*

Ophth., 1947, Jan.-Feb., pp. 198-209.

Marginal corneal ulcers are by far the most common corneal disease in this country. They are usually secondary to conjunctival and systemic disease. The most frequent types are the simple catarrhal, ring, and chronic serpiginous (Mooren's ulcer). In a detailed study of 200 consecutive cases of marginal ulcer, 180 were catarrhal, 14 ring, and 6 serpiginous. Of the 180 catarrhal ulcers, 156 were secondary to chronic catarrhal conjunctivitis, 12 to acute catarrhal conjunctivitis, 4 to endogenous conjunctivitis, and 8 without associated conjunctivitis. Staphylococci were isolated in 133, diplobacilli in 11, Koch-Weeks bacilli in 8. Coincidental blepharitis and conjunctivitis were a constant feature of ulcers caused by staphylococci and diplobacilli. In the treatment of the staphylococcal group, 5-percent sulfathiazole ointment, penicillin ointment, and 1:5000 oxycyanide with ammoniated mercury were most efficient. Staphylococcal toxoid was a successful adjunct in some cases. Topical applications to the ulcer apparently did not shorten its course, as did the treatment of the conjunctiva and lid margins with sulfonamides. There was no evidence that riboflavin or other vitamin deficiencies were a predisposing cause to marginal ulceration. Of the 14 ring ulcers, 3 were associated with bacillary dysentery, 2 with influenza, 1 with periarteritis nodosa, 2 with arthritis deformans, and 1 with lupus erythematosus. Ring infiltrate and ulcers secondary to staphylococcal conjunctivitis responded well to penicillin ointment. In one case due to bacillary dysentery, the use of sulfonamides was followed by rapid improvement. Paracentesis with intravenous typhoid therapy was also possibly of

value. In the treatment of chronic ser-piginous ulcers sulfonamides and penicillin were without effect. Gifford's de-limiting keratotomy apparently pre-vented advancement in some. Bacterial and other allergies may have been a causative factor in some cases. Marginal keratitis with acne rosacea is believed to be due to secondary staphylococcic infection.

Chas. A. Bahn.

Thorne, B. Epidemic keratoconjunctivitis in Bengal. *Lancet*, 1946, v. 2, Nov. 16, pp. 715.

The author reports an epidemic of keratoconjunctivitis which occurred in 17 members of the R.A.F. in the Calcutta area. The disease was unilateral in 15 patients, appeared after an incubation period of 12 to 17 days, and lasted one to three weeks. Conjunctival cultures were negative, and no specific treatment was instituted.

Benjamin Milder.

Tikhova. The use of albucide in the treatment of corneal ulcer, conjunctivitis, and trachoma. *Vestnik Oft.*, 1946, v. 25, pt. 4, pp. 30-32.

Tikhova illustrates with case reports the beneficial effect of instillations and subconjunctival injection of 30-percent aqueous solution of albucide and of similar ointments on the healing of corneal ulcers, arrest of secretion in conjunctivitis, and absorption of infiltrates in trachomatous pannus.

Ray K. Daily.

Van Veelen, A. W. C. Bilateral spontaneous rupture of Descemet's membrane. *Ophthalmologica*, 1946, v. 112, Sept., pp. 149-154.

A 32-year-old imbecile suddenly, and apparently spontaneously, developed a circumscribed clouding and thickening

to three times normal of the cornea of first one eye and then the other. The clinical picture closely resembled that of acute hydrops of the cornea due to rupture of Descemet's membrane as it occurs in keratoconus, but all other signs of this disease were absent. One eye was enucleated because of marked proptosis and threatening perforation. In the other eye the area of corneal edema became regressive under conservative therapy and finally healed, leaving behind only a slightly protruding superficial corneal scar. Histologic examination of the enucleated eye revealed a primary rupture of Descemet's membrane with consequent severe edema of the stroma and secondary enzymatic breakdown of corneal tissue to the point of cavity formation. The cellular reactions were regenerative and reparative, rather than inflammatory. The question arises whether further observation will disclose signs of keratoconus. The author believes that self-inflicted injury can be ruled out.

Peter C. Kronfeld.

Zondek, Bernhard, and Bromberg, Y. M. Treatment of keratitis rosacea with small doses of testosterone. *Nature*, 1947, v. 159, Feb. 1, p. 171.

Six patients with keratitis rosacea gave a positive intracutaneous test with testosterone. Tests with several other steroid hormones were negative. Striking improvement of the ocular condition in all the patients followed the intracutaneous administration of increasing doses of testosterone. When facial rosacea was present this also was markedly improved.

Despite the favorable results obtained, allergy to testosterone seems to be a cause in a high percentage of cases.

Francis M. Crage.

7

UVEAL TRACT, SYMPATHETIC
DISEASE, AND AQUEOUS
HUMOR

Arruga, H. The simultaneous detachment of the choroid and the retina after a cataract operation. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Feb., pp. 119-125. (See Section 9, Crystalline lens.)

Cavallacci, G. Uveoparotitis (syndrome of Heerfordt) and benign lymphogranulomatosis (disease of Besnier-Boeck-Schaumann). *Arch. di Ottal.*, 1946, v. 50, July and Aug. pp. 154-168.

Cavallacci reports one case of Heerfordt's disease. The patient had bilateral parotitis, and bilateral anterior chronic uveitis accompanied by recurrent mild fever. Absence of involvement of the cranial nerves is notable; most commonly involvement of the facial nerve is reported. Physical examination revealed mild hepatosplenomegaly and diffuse and painful swelling of the lymphatic glands. X-ray examination showed hilar adenopathy.

The intradermal reaction to tuberculin was positive. Histologic examination showed evidence of a reticuloendothelial disturbance, confirmed by monocytosis produced by adrenalin contraction of the spleen and by a study of smears following sternal puncture.

Four etiologic factors have been considered by the various authors: epidemic parotitis, syphilis, tuberculosis, and infection by an unknown virus. The unknown virus hypothesis has been championed primarily by Pautrier. He has shown in a very extensive monograph a great similarity between Heerfordt's disease and the disease of

Besnier-Boeck-Schaumann, and believes that Heersfordt's disease is a cephalic localization of the latter, which is a complex picture that includes lupus pernio of Besnier, cutaneous sarcoidosis of Boeck and benign lymphogranulomatosis of Schaumann. It is a lymphatic disease with a benign course and is to be differentiated from malignant lymphogranulomatosis of Hodgkin-Paltauf-Sternberg.

A comparative histologic picture is common to the two diseases, characterized by involvement of the connective tissue with isolated or confluent nodules, of varied size, which are composed of aggregates of epitheloid cells, a minimum of lymphoid cells, and occasional giant cells. The most important finding is the absence of degenerative changes and caseation. Mickulicz disease and Sjögren disease may also be a part of the syndrome of Besnier-Boeck-Schaumann.

A similar histologic picture can be obtained in many disease processes, and reticuloendotheliosis is not a response to a specific organism but rather the reaction to any one of many organisms which can call forth an immunizing allergic change. Cavallacci points out that his patient showed a positive tuberculin test, and favors this as the etiologic agent in his case.

Francis P. Guida.

Chavarria, F. A. The importance of the ophthalmoscopic examination in conditions affecting the external parts of the eyes. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Feb., pp. 161-169.

The author insists on the routine ophthalmoscopic examination even in those patients who complain of external conditions of the eyes. A patient was referred to him for operation on a

pterygium of the right eye, which had almost reached the pupillary margin and obstructed his vision. Fundus examination revealed a tumor of the choroid of the right eye which necessitated enucleation of the eye. (7 illustrations.) J. Wesley McKinney.

Dean Guelbenzu, Manuel. Colloidometry of the aqueous humor. Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, Dec., pp. 1266-1276.

Dean Guelbenzu reports his colloidometric studies of the aqueous humor in various ocular diseases. There is an increased concentration of albumen in inflammations of the iris, ciliary body, and anterior part of the choroid, in corneal diseases accompanied by pericorneal congestion, in deep inflammations of the conjunctiva, in limbal phlyctenular keratitis, in acute inflammatory glaucoma, and after trauma which produces a sudden drop in tension. It is apparent that there is an inflammation of the ciliary body, and an alteration of vascular permeability in the region of distribution of the long ciliary arteries or the arteries anastomosing with them. The increased colloid content of the aqueous indicates a more or less pronounced cyclitis, and this sign may be the only evidence of a painless, quiet iritis. (Illustration.)

Ray K. Daily.

Gsell, O., Rehsteiner, K., and Verrey, F. Iridocyclitis following leptospirosis pomona. Ophthalmologica, 1946 v. 112, Dec., pp. 320-334.

The leptospiroses comprise a group of diseases of worldwide distribution due to infection with various species of pathogenic leptospira. The best known leptospirosis is infectious jaundice or Weil's disease of which iridocyclitis is a characteristic and fairly

common complication. An acute, infectious, chiefly meningitic disease occurring characteristically in swineherds has been found to be a leptospirosis, due to infection with *Leptospira pomona*. A typical case of this disease occurred in a young man whose job it was to clean a large pigpen. Eleven days before the onset of the systemic disease, he had sustained an incised wound on one hand while at work. The wound "healed poorly," but did not cause any particular discomfort. The systemic disease took the course of a mild serous meningitis that subsided in three weeks. The leptospira could be cultured from the patient's blood on the third and fourth day, but not thereafter. Three months later the patient developed a mild iridocyclitis in one eye with a fibrous exudate that changed later on to precipitates and small brownish-gray nodules at the pupillary border. At the height of the iridocyclitis aqueous was aspirated and found to contain agglutinins for *Leptospira pomona* in significant concentration (in contradistinction to aqueous from other patients). "Since any other cause of the iritis could be excluded, it can only be regarded as a late complication of leptospirosis." The fact that the aqueous contained chiefly lymphocytes instead of the polymorphonuclear leukocytes which one would have expected to find in a fairly acute iritis, is stressed as another possible characteristic of the iridocyclitis due to leptospira.

Peter C. Kronfeld.

Johnson, L. V., Fried, N., Broadus, C. C., and Lamfrom, H. Use of neutralizing antibody test in diagnosis of human toxoplasmic choroiditis. Arch. of Ophth., 1946, v. 36, Dec., pp. 677-684.

The procedure for the neutralizing antibody test for toxoplasma is described. Suspected serum is mixed with a suspension of the organism from mouse brain. This mixture is injected beneath the skin of a rabbit and the size of the lesion produced is compared with the lesion produced by the injection of the suspension of organism alone. In positive tests the antibodies in the serum inhibit the development of the skin lesion in the rabbit.

Thirty-two selected patients with chorioretinitis were tested; 20 of these gave positive reactions in the neutralizing antibody test. Cerebral calcification in patients who had toxoplasmosis with chorioretinitis was not observed when the age of onset was known to be over 15 years. If the disease was present at birth, calcification was evident.

A mother with reactivated toxoplasmic choroiditis and a woman who was probably congenitally infected each gave birth to a normal child. Two children probably infected congenitally with toxoplasmosis had younger siblings-german with antibody protection but no demonstrable infection. A case of chronic toxoplasmosis is described in which a quiescent chorioretinal lesion became activated during each of three pregnancies. (Color drawings of chorioretinitis.) John C. Long.

Jona, S., and Sartori, A. Heerfordt's syndrome, a particular variety of Besnier-Boeck-Schaumann's disease. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, Sept.-Oct., pp. 289-312.

A woman, 60 years of age, had bilateral iritis, bilateral parotid tumor, and paresis of her left seventh nerve. Biopsy of the tumor led to the diagnosis "Reticuloendotheliosis Besnier-

Boeck-Schaumann, subtype Heerfordt's syndrome." A tuberculous etiology was excluded. The authors assume that the syndrome was caused by a hitherto unidentified virus. (8 illustrations, bibliography.) K. W. Ascher.

Longhena, Luisa. The recurrent hypopyon-uveitis associated with mucocutaneous changes. *Riv. Oto-Neuro-Oft.*, 1946, v. 21, March-April, pp. 108-131.

Five cases are reported of a syndrome characterized by a typical uveitis associated with recurrent hypopyon of sudden onset, alternately in one eye or the other, and lesions of the mucous membranes and skin. A woman, 36 years of age, exhibited the typical eye symptoms, calcification of hilar glands and a positive tuberculin test. The vaginal mucous membrane presented superficial ulcers at each recurrence. Four other patients also had positive evidence of tuberculosis. After a long discussion of the different theories of the etiology of this disease the author concludes that the clinical and radiologic demonstration of pulmonary and extrapulmonary tuberculosis strongly suggests that the disease is a form of tuberculosis. (Bibliography.)

Melchior Lombardo.

McLean, D. W. An unusual case of intra-ocular hemorrhage. *Brit. Jour. Ophth.*, 1946, v. 30, Dec., p. 758.

Bleeding occurred from a strand of persistent pupillary membrane after very light trauma. After uneventful healing, the strand remained and in it could be seen a patent blood vessel in which movement of blood could be observed. Morris Kaplan.

Neubert, F. R. Posterior uveitis in a case of sarcoidosis. *Brit. Jour. Ophth.*,

1946, v. 30, Dec., pp. 724-728.

The author could find no record of posterior uveitis due to sarcoid and presents this case report as the first in the literature. In a young man who stated that his vision had rapidly deteriorated after looking at an eclipse, both fundi showed disseminated choroiditis with extensive scarring and pigment deposition. No diagnosis was made until he later developed signs of pulmonary tuberculosis with intestinal involvement. Resection of the cecum revealed sarcoidosis. Without further treatment, his general health and his vision improved. The fundus pictures remained the same. (2 figures.) Morris Kaplan.

Prosser Thomas, E. W. So-called triple symptom complex of Behcet. *Brit. Med. Jour.*, 1947, Jan. 4, pp. 14-16.

In 1937 Behcet described an entity that consists of grave ocular disease and ulcers of the mucosa and external genitals. This is the first case to be reported in England. Eventually one eye had to be enucleated. Pathologic examination of the ocular tissue was not diagnostic. There was complete retinal detachment, gross intra-ocular hemorrhage, mainly subretinal, and marked patchy thickening of the ciliary body and choroid. (References.)

Bennett W. Muir.

Samoilov, A. I. Present day conception of the pathogenesis of intraocular tuberculosis. *Vestnik. Oft.*, 1946, v. 25, pt. 6, pp. 3-7.

Samoilov believes that traces of an old tuberculous intrathoracic process can be found in the intrathoracic lymph glands or in the pulmonary parenchyma in every case of ocular tuberculosis. The bacilli circulating in the blood are arrested in the vascular

labyrinth of the choroid and set up a small symptomless focus, which rapidly becomes and remains latent. At some future time lowered resistance permits the process to become active and at that time it is the only active tuberculous process in the organism. Samoilov's method of tuberculin therapy with focal reactions is based on this pathogenetic hypothesis.

Ray K. Daily.

8

GLAUCOMA AND OCULAR TENSION

Boxill, W. M. de C. The flap sclerotomy in the treatment of glaucoma. *Brit. Jour. Ophth.*, 1947, v. 31, Feb., pp. 72-78.

The author describes in detail the flap sclerotomy which is Sir Richard Cruise's modification of the idea originated by Herbert in 1907. It has been used successfully in acute congestive glaucomas as well as chronic glaucomas for which it was designed. Under a conjunctival flap with corneal splitting a blunt triangular sclerotomy with corneal hinge is made. Postoperatively gentle massage is performed to delay primary union. After a permanent filtering cicatrix is produced the massage is discontinued.

O. H. Ellis.

Braitseva, M. K. Campimetry in the study of glaucoma. The effect of decompressing operations on the retinal edema and ophthalmotonus. *Vestnik Oft.*, 1946, v. 25, pt. 5, pp. 7-12.

A tabulated report is given of a study of the effect of an Elliott operation on the size of the central and peripheral field and the ocular tension in 16 patients with glaucoma. An enlarged blind spot, found preoperatively, and interpreted as a sign of retinal edema, was reduced to normal immediately af-

ter the operation when the tension was subnormal. The blind spot remains within normal limits for at least ten days. After that the parallelism between the size of the blind spot and the intraocular tension does not continue. After six to eight weeks the enlargement of the blind spot recurs, and vision falls. There is apparently a constant parallelism between the scotoma due to retinal edema and visual deterioration. Another significant table contains the data on 138 glaucoma patients followed from one to ten years. It clearly shows a progressive deterioration of vision with a stable, normal ocular tension. At the end of one year, more than half of the patients retained their preoperative visual acuity; at the end of three years this was true of only one third of the patients, and at the end of ten years of only 11 percent. At the same time the tension remained normal in 92 percent of the eyes. The data support the conception of glaucoma as an initial retinal edema which gradually leads to irreversible atrophic changes of the nerve tissue, manifested in the late stages by peripheral contraction of the field or ring scotomas.

Ray K. Daily.

Cruise, Richard. The production of a filtering cicatrix in glaucoma. *Brit. Jour. Ophth.*, 1947, v. 31, Feb., pp. 65-72.

Cruise presents the microscopic study of an eye upon which he had successfully performed his hinged-flap sclerotomy twelve years previously. The subconjunctival drainage area and corneoscleral tract were largely filled with a sponge of very delicate connective tissue. The walls of the tract were lined in part by definite endothelium; elsewhere the sclera was bare. In the

latter areas the sclera had undergone no apparent change since the day of the operation. (10 figures and photomicrographs.)

O. H. Ellis.

Dashevsky, A. I. New pathways for the study of ocular tension. *Vestnik Oft.*, 1946, v. 26, pt. 5, pp. 18-27.

This is a preliminary report, with tabulated data on elastotometry with a new instrument designed by the author. The technique allows a clearer recognition of the two basic factors in measurements of ocular tension: the true intraocular pressure, and the coefficient of the ocular reaction to pressure exerted by the instrument. The author presents a formula for calculating the coefficient of the ocular reaction to pressure, and the true intraocular pressure. The resolution of the data into their basic components permits a better understanding of the factors involved in the maintenance of the hydrodynamic ocular equilibrium. The reaction of the eye to pressure depends on the vascular apparatus of the eye, and the data show that it is directly proportional to the difference between the diastolic retinal pressure and the true intraocular pressure. When the two are equal, the coefficient of reaction becomes equal to zero. This indicates that the reaction coefficient is due to the difference in pressure on either side of the vessel wall, and that the vessel wall is the anatomic site of the process interpreted by the coefficient of reaction. Retinal edema is a manifestation of disturbances in the vessel wall. This supports the existence of a relationship between retinal edema and ocular tension.

Ray K. Daily.

Downey, H. R. Unequal tension as a sign in early glaucoma. *Trans. Amer.*

Ophth. Soc., 1945, v. 43, pp. 495-504.

The author calls attention to the importance of unequal tension in the two eyes as a prodromal sign of the "preglaucoma stage" in patients over the age of 40 years. A difference in tension of 4 mm. and more is significant even in the absence of other manifestations of glaucoma. He found this difference in one third of 620 patients with healthy eyes and as frequently before the age of 40 years as after. He reports six cases of definite glaucoma in patients over 40 years of age whose only initial sign of preglaucoma was a difference in tension. C. D. F. Jensen.

Filatov, V. P. Remarks on the technique of the LaGrange-Holt operation. *Vestnik Oft.*, 1946, v. 25, pt. 5, pp. 39-41.

The distinguishing points of the technique are the use of a blunt-pointed keratome to make the incision, after the anterior chamber has been entered with a sharp-pointed keratome; the performance of a prophylactic sclerectomy in anticipated expulsive hemorrhage; and the use of tissue implantation to stimulate the recuperative forces of the organism.

Ray K. Daily.

de Grosz, Istvan. Quantitative determination of follicular hormone in eye diseases. *Acta Ophth.*, 1941, v. 19, pt. 2, pp. 134-140.

Thirteen patients with glaucoma and eight with other eye diseases were tested for ovarian inadequacy by the determination of the folliculin content of the urine. The data show a low content of estrogenic substances, and suggest an etiologic relationship between ovarian inadequacy and certain types of glaucoma.

Ray K. Daily.

Hess, Lco. Pathogenesis of glaucoma and "glaucomatous" atrophy of the optic nerve. *Arch. of Ophth.*, 1947, v. 37, March, pp. 324-335.

This paper is one of a series on glaucoma by this author. He here brings out the point that glaucoma may be dependent not only on congenital anomalies of the eye, but may be associated with organic changes in the nervous system.

R. W. Danielson.

Jona, S. Injection of hypertonic glucose in the pre-operative treatment of glaucoma. *Rassegna Ital. d'Ottal.*, 1942, v. 11, March-April, p. 83.

The various salts and solutions which have been employed in the attempt to reduce the intraocular pressure in glaucoma are reviewed. The author doubts their value, except in the preoperative period and when combined with the use of miotics, at this stage. Twenty cases are reported in which 100 c.c. of 50-percent solution of glucose was injected intravenously in a period of ten minutes. In all of these patients there was a moderate reduction of pressure, lasting about two days. There were no inconveniences attendant upon the use of the glucose solution, and its employment before surgery is recommended.

Eugene M. Blake.

Just-Tiscornia, Benito. Intraocular hypertension. Is the cause local or general? *Arch. de la Soc. Oft. Hisp. Amer.*, 1946, v. 6, Oct., pp. 989-998.

This is a report on a patient with general hypertension, with signs of bilateral vascular hypertension in the fundus and raised ocular tension, and with thrombosis of the central retinal vein and glaucomatous excavation in the right eye. The author believes that the local changes in the ocular capil-

laries form the fundamental disturbance, which leads to the increased intraocular pressure, and that the general high blood pressure had no significant influence on the ocular tension.

Ray K. Daily.

Kolenko, A. V. **Metabolism in glaucoma patients.** *Vestnik Oft.*, 1946, v. 25, pt. 5, pp. 45-47.

The data on metabolism of 100 glaucoma patients, 71 with primary and 29 with secondary glaucoma, show that metabolism is usually raised in patients with primary glaucoma, and low in patients with secondary glaucoma.

Ray K. Daily.

Lawrence, Arthur. **Glaucoma following herpes.** *M. J. Australia*, 1947, v. 1, Jan. 18, p. 78.

The author presents four brief case reports to draw attention to the fact that glaucoma may follow herpes. Although this is probably secondary glaucoma, the glaucoma may supervene when no sign of iritis can be detected with the slit lamp. F. H. Haessler.

Marin Amat, M. **The pathogenesis of glaucoma.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Oct., pp. 1012-1026.

The author's conception of the pathogenesis of glaucoma is summarized. The rise of intraocular pressure is produced directly by the increased intraocular volume of blood and lymph; obstruction to drainage is secondary. A rapid rise in intraocular contents produces an acute glaucoma; if the increase takes place slowly the glaucomatous process is chronic. The control of the intraocular circulation is under the influence of the sympathetic system, directed autonomically and locally by the small ganglia situated within the ciliary body and the

choroid. Dysfunction of the local regulating mechanism breaks the sympathetic-vagotonic equilibrium which regulates the quantity of blood entering and leaving the eyeball. The result of this disturbance is a vasodilatation and stasis, increased permeability of the capillary endothelium, and intraocular hypertension. The mechanism of the dysfunction may be a primary excitation of the sympathetic followed by an overactivity of the parasympathetic, or a primary parasympathetic excitation. Consequently glaucoma is always predominantly a reaction of the vagus. The clinical implications of this concept are the importance of prophylactic avoidance of all excitation of the sympathetic nervous system and the necessity of acting therapeutically on the nervous plexus in the ciliary body and the root of the iris. The therapeutic goal should be a diminution in the production of intraocular fluids and not promotion of their elimination. The autonomic function of the local sympathetic innervation of the eyeball explains the failure of intervention on the sympathetic cord or its ganglia to reduce ocular tension.

Ray K. Daily.

Marlow, Searle B. **The field of vision in chronic glaucoma.** *Trans. Amer. Ophth. Soc.*, 1945, v. 43, pp. 608-625.

The author presents his observations on 50 cases of chronic glaucoma, showing the effect of reduced illumination on the field of vision. He compares his findings with those of earlier observers, emphasizing the conclusions of outstanding investigators in the field of perimetry such as Traquair and Ferree and Rand. He presents 13 perimetric charts which demonstrate the amplification of known or suspected field de-

fects by the use of illumination reduced to an intensity of 0.20 foot candles. He compares these field findings to those with full illumination which ranged from 10 to 40 foot candles in intensity. He concludes that in all perimetric studies the illumination should be measured and recorded.

C. D. F. Jensen.

Norkus, V. N. Elastotonometric investigations with the pressure test in glaucoma. *Vestnik Oft.* 1946, v. 25, pt. 5, pp. 35-39.

The technic of the Dashevski pressure test is as follows: the corneal diameter is reduced to and maintained at 7.9 mm. by pressure with the glass prism of the elastotonometer. Tonometric readings are taken every 10 seconds for two minutes, and the data charted to form a curve. The object of the test is to elucidate the changes that take place in the normal and glaucomatous eye under pressure. The reaction has two phases: a fall in ophthalmotonus, and its restoration. This investigation was concerned with the component factors of ocular tension in the phase of restoration. The eye was subjected to an elastotonometric examination, then subjected to pressure for two minutes, and the elastotonometric examinations were repeated every five minutes until the original level of ocular tension was restored. The tests were made also on the fellow eye that was not subjected to pressure. The data on 22 glaucoma patients show that the eye responds to pressure by a change in the ocular tension and in the coefficient of reaction. These two basic factors change in opposite directions in eyes with a normally functioning regulating mechanism of ocular tension. With a high true intraocular pressure the

changes in the coefficient of reaction are insignificant. The tonometric tension as understood clinically is modified in the presence of high true intraocular pressure. In average and low true intraocular pressure both the pressure and the coefficient of reaction participate in the change. In slight compression of the cornea as is practiced clinically the tonometric reading depends but little on the coefficient of reaction. The changes in the fellow eye were similar to those in the eye that was subjected to pressure.

Ray K. Daily.

Parker, F. C. Modified corneal incision with iridodialysis and iridectomy for opening the anterior chamber angle. *Arch. of Ophth.*, 1947, v. 37, March, pp. 277-281.

When one visualizes the point of attack in making the incision for the conventional iridectomy, one cannot but be impressed with the fact that the very area, namely, the angle of the anterior chamber, which should be kept patent, is in serious danger of being subsequently closed by cicatricial contraction or resultant inflammatory changes. An area which should be kept free is traumatized, with the possibility of producing conditions worse than the primary one.

Parker says that the failures in some cases of basal iridectomy might be attributed to the aforementioned location of the conventional incision. In performing an iridectomy, it is almost impossible to cut down to the base of the iris without leaving a stump, however small. Any remnants of iris can still block the angle. He, therefore, places the incision in the clear cornea away from the limbus, where subsequent contraction and other changes would

not in any way interfere with drainage. In addition, the location of the incision facilitates iridodialysis, which is the best procedure for clearing the angle of the anterior chamber.

With a Graefe knife, an incision is made straight through and across the cornea about 3 mm. below the limbus, with the blade of the knife tilted slightly downward to make a beveled cut. The iris is grasped well toward the base and pulled slightly downward with a swaying motion, and is stripped clean from its base high up in the angle. The resulting coloboma can be made of almost any size desirable. The iris is drawn down and out through the incision and cut off first at one extremity of the incision, after it has been pulled away medially from the end of the wound, and then at the opposite end. In replacing the pillars, the tiny stream of an anterior chamber irrigator is employed rather than a spatula, to guard against any possible damage to the capsule of the lens.

Parker does not advocate the performance of this iridodialysis and iridectomy through the modified corneal incision in every case of glaucoma. It should be employed in any eye in which iridectomy might be considered.

R. W. Danielson.

Payne, B. F. Causes of failure of glaucoma operations. *Southern Med. Jour.*, 1947, v. 40, Jan., pp. 11-17.

Unsuccessful glaucoma surgery requires that the surgeon, in fairness to his patient, himself, and the profession, investigate the cause for the failure. Histologic study of enucleated eyes in the cases showing poor results is required. The causes for such results in some of the common operations for acute and chronic glaucoma are studied and reported.

Before showing the histologic changes in glaucoma, the microscopic anatomy of the normal globe is briefly reviewed.

Enucleated glaucomatous eyes following unsuccessful iridectomy, iris inclusion operation, cyclodialysis, and trephine showed thinning of the sclera and cornea, changes in the corneal epithelium, congested scleral sulcus and limbus, shallow anterior chamber, anterior peripheral synechias, and atrophy of the iris and ciliary body.

Photographs of sections of enucleated globes after the above named unsuccessful operations clearly illustrate the cause of the failures. In the iridectomy the root of the iris was left behind and the synechias therefore not relieved. The iris inclusion drainage canal was not permanent. Inflammation closed the tract made by the cyclodialysis operation. The trephine failures were due to collapse of the bleb, late infection, and fibrotic closure. (Photomicrographs.) Francis M. Crage.

Rios Sasiain, Manuel. The mechanism of introcular hypertension in the light of the polarographic method. *Arch. de la Soc. Oft. Hisp.-Amer.*, v. 6, 1946, Oct., pp. 999-1011.

Rios subjected the intraocular fluid to an examination by the polarographic method, with the curves recorded photographically. The analytic apparatus and the preparation of the intraocular fluid obtained through posterior sclerotomy or from the anterior chamber is described in detail. The normal aqueous is alkaline, and the polarographic curve indicates the presence of a small protein content in the intraocular fluids. In the hypotensive eye the polarographic curve shows an increase in protein which inhibits the reduction of the ions of cobalt. In the hypertensive

eye the physicochemical equilibrium, which regulates ocular tension is disturbed; neurovegetative instability, endocrine dysfunction, intramural action of histamin, or all of these factors combined, lead to a vascular dilatation and increased capillary permeability. This leads to the diffusion of colloidal proteins, which normally do not pass through vascular walls; the osmotic pressure of the intraocular fluid rises, and the quantity of the intraocular fluid is increased. Chemically the passage of negative ions into the eye raises the alkalinity, and the pH becomes further removed from the isoelectric point.

Ray K. Daily:

Rokitskaia, L. B. Investigations of the oculoöcular phenomena by elastotometry. *Vestnik Oft.* 1946, v. 25, pt. 5, pp. 28-31.

This is a further investigation in the elucidation of the mechanism of the binocular response to a monocular stimulus. It is generally regarded as a vasomotor reaction, transmitted to the fellow eye through nervous associations. Dashevsky's investigations with elastotometry revealed that the clinical tonometric data consist of the interaction of two factors: the true intraocular tension and the coefficient of reaction. Elastotometric data determine the reaction coefficient, or the reactive capacity of the eyes. Inasmuch as this coefficient is determined by the elasticity of the vascular wall, a study of the coefficient may give some indication of the part played by the vascular system in the various processes concerned. This study was concerned with the binocular reaction to pressure on the globe with Dashevsky's instrument, which acts on the true intraocular pressure, and to retrobulbar injections of 1:1000 solution of atropine, which

acts directly on the vessel wall and thus indirectly on the coefficient of reaction. The graphically reported data show that in normal eyes the effect of pressure on the true intraocular tension and on the coefficient of reaction runs parallel in both eyes, and that pressure on one eye elicits a binocular response which is less marked and appears somewhat later in the fellow eye. In eyes with glaucoma the reactions were variable and inconstant, owing probably, to the extreme lability of the nervous mechanism of such eyes. Retrobulbar injections of atropine produced definite changes in the coefficient of reaction in most cases with but little effect on the true ocular tension and the same response was found in the fellow eye. These findings thus cast doubt on the conception of oculoöcular reactions as purely vasomotor phenomena.

Ray K. Daily.

Sadikova, V. C. Results of cyclodialysis. *Vestnik Oft.*, 1946, v. 25, pt. 5, pp. 42-45.

A review of the literature, and an analysis of 100 operations on 93 patients is reported. Among these were 7 cases of compensated glaucoma, 87 of uncompensated, 2 of absolute, 1 of acute glaucoma, and 3 of juvenile. There was a shallow anterior chamber in 70 cases, moderate in 21, and deep in nine. There was postoperative iridocyclitis in six. The criteria in this investigation were the visual acuity, peripheral fields, and ocular tension. The tabulated data show an improvement in visual acuity in patients with poor vision. In patients with good vision there was a reduction in visual acuity in 25 percent attributed to the changes brought about by the surgical intervention, such as pigment in the anterior chamber, folds and detachment of

Descemet's membrane, and refractive changes. In 86 cases ocular tension was gradually reduced, as were the oscillations in ocular tension. The visual field increased in 25 patients and became contracted further in 11. (4 tables.)

Ray K. Daily.

Samoilov, A. I. **New pathways in the study of glaucoma.** *Vestnik Oft.*, 1946, v. 25, pt. 5, pp. 3-7.

The theories on the pathogenesis of glaucoma are reviewed. Samoilov is convinced that the basic process in the initial stage of glaucoma is an edema of the eyeball, localized predominantly in the retina, and has specific characteristics. Among these is the typical reaction of the glaucomatous eye to pilocarpine and adrenaline. Adrenalin has a pronounced pupillomotor effect but no effect on the retinal edema; pilocarpine produces less miosis in the glaucomatous eye than in the normal, but produces a significant diminution in the retinal edema. If persistent the retinal edema gradually passes into an atrophy of the optic nerve. This process is not specific for glaucoma. The fact that the visual acuity continues to deteriorate in many cases in which the tension has become normal after surgery is evidence to Samoilov that the ocular tension is not the cause of the visual deterioration.

Ray K. Daily.

Samoilov, A. I., and Briantseva, M. K. **Campimetric test in darkness in the diagnosis of prodromal glaucoma.** *Vestnik Oft.*, 1946, v. 25, pt. 5, pp. 12-17.

The most sensitive test for prodromal glaucoma is the demonstration of the presence of retinal edema through an enlargement of the blind spot. This demonstration is possible under conditions of dark adaptation before it is

demonstrable in the light adapted eye. One has the patient remain in a dark room for one hour, takes the adaptation curve to verify the state of adaptation, and then outlines the blind spot, using a feeble light for fixation, and a small red light for the test object. After a return to normal illumination the blind spot soon resumes its normal size. One of the interesting observations made in the course of this investigation, was that frequently the normal eye of a glaucomatous patient showed an enlarged blind spot in dark adaptation. Of nine eyes found normal ophthalmoscopically, tonometrically, and functionally only three had a normal size blind spot when dark adapted. (Adaptation curves, blind spots.) Ray K. Daily.

Sugar, H. S. **Acute glaucoma: a follow-up study.** *Amer. Jour. Ophth.*, 1947, v. 30, April, pp. 451-468. (1 chart, 3 tables, 8 references.)

Vanýsek, Jan. **The problems of glaucoma.** *Brit. Jour. Ophth.*, 1946, v. 30, Dec., pp. 742-748.

The author believes that glaucoma may be an expression of tissue edema in the eye; this is either an ordinary edema or more probably an allergic type. The ordinary swelling may be either inflammatory, as in iritis or iridocyclitis, or cardiac edema, as in thrombosis of the central vein of the retina. The allergic edema is brought about by an imbalance in opposing divisions of the vegetative nervous system. The frequency with which glaucoma is precipitated by excitement that upsets balance between the sympathetic and the parasympathetic functions is cited as evidence of this. A further evidence is given the fact that tension is higher during the night when the sympathetic system is more active, and less ele-

vated during the day when the parasympathetics hold sway. The author acknowledges there is no proof of this hypothesis, but feels that much more thought should be given it.

Morris Kaplan.

Vidal, F., and Malbrán, J. L. Chronic primary glaucoma and differential white cell count. *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Jan.-March, p. 58.

The differential white cell count in the blood of 21 patients with chronic primary glaucoma and 14 with secondary glaucoma was found to be normal. (Bibliography.) Plinio Montalván.

Vintserevich, M. A. Elastotonometric analysis of the action of miotics in glaucoma. *Vestnik Oft.*, 1946, v. 25, pt. 5, pp. 32-35.

The material for this investigation comprises 67 glaucoma patients tested for the effect of miotics, and 200 glaucoma patients examined without consideration of the action of miotics. The elastotonometric data show a variable response to miotics owing, probably, to the extreme lability of the nervous system in glaucoma. Varying and sometimes contradictory responses may follow the same stimulus. Nevertheless the data reveal a number of interesting phenomena. They show that the lower the true ocular tension is, the higher is the coefficient of reaction. A low coefficient of reaction was found in eyes with absolute glaucoma with a high true ocular tension. In compensated glaucoma the coefficient is higher. An elastotonometric examination furnishes three data: a tonometric datum which is obtained by measuring the pressure necessary to deform the cornea to produce a plane surface 4.8 and 7.9 mm. in diameter; and the true intraocular

pressure and the reaction coefficient, which are calculated. Under the influence of miotics the tonometric data remain unaltered, and the true ocular tension and the reaction coefficient undergo a change usually in opposite directions. In lower tension the coefficient rises and vice versa. In a few cases the two components change in the same direction. No significant difference was found in varying the concentration of the miotics. In the light of elastotonometric data our conception of the action of miotics needs revision. (Elastotonometric curves.)

Ray K. Daily.

Wexler, D., and Kornzweig, A. Buphthalmos in a six month premature infant. *Arch. of Ophth.*, 1947, v. 37, March, pp. 318-323.

Infantile glaucoma, or buphthalmos, has been discovered occasionally in newborn infants at term. The present case is of special interest because it affords an opportunity to study congenital glaucoma in microscopic section at an earlier stage than has hitherto been possible. On section, it was found to belong to the small group of cases of buphthalmos characterized by absence of Schlemm's canal, complete anterior iris synechias and very shallow or absent anterior chamber. These anatomic features were striking in comparison with the deep anterior chamber and hydrophthalmos more commonly found in congenital glaucoma.

Of clinical interest in this premature infant with buphthalmos is the presence of a hereditary tendency to familial congenital glaucoma, and of consanguinity of the grandparents. Detailed measurements of the eye are compared to those of a normal six-month fetus.

R. W. Danielson.

9

CRYSTALLINE LENS

Arruga, H. The simultaneous detachment of the choroid and the retina after a cataract operation. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Feb., pp. 119-125.

In 1868, H. Knapp described the first case of detachment of the choroid in an enucleated eye recently operated upon for cataract. At the time of the enucleation, it was believed that the patient had developed a sarcoma of the choroid. In the presence of detachment of the choroid following cataract extraction or trephining the patient is usually not aware of any disturbance but if the detachment is very large he may notice the contraction of the visual field with an area of blindness having a convexity directed toward the center. The retraction of the visual field goes through a period of progression and regression which may last days or weeks. With rare exceptions there is complete restitution. The fundus may show one or more raised areas resembling a tumor of the choroid. The mass is not opaque to transillumination and shows a hard reddish reflex. The rest of the fundus is normal. The anterior chamber is almost always very shallow due to the lack of healing of the operative wound. Predisposing causes of the detachment are considered to be old age, hypertension, and dyscrasias, especially diabetes. In a few cases there is an associated detachment of the retina which carries the same favorable prognosis as the choroidal detachment. It is believed that the detachment is probably due to congestion ex vacuo which produces an exudate from the vascular membrane itself. The retinal detachment is thought to have the same cause. The author has examined 242 pa-

tients postoperatively. He observed detachment of the choroid in 9; in 3 of the 9 there was also a contiguous detachment of the retina. He concludes that the above figures indicate the relative frequency of choroidal detachment and associated retinal detachment resulting from intraocular surgery. (4 illustrations.) J. Wesley McKinney.

Bettman, J. W. Production of cataracts in chicks with dinitrophenol. *Arch. of Ophth.*, 1946, v. 36, Dec., pp. 674-676.

It has not been found possible to experimentally produce cataracts in mammals by the ingestion of dinitrophenol, although this has been done in young chicks and ducks. The author produced cataracts in 3½-weeks-old pullets by placing them on a diet containing 0.25 percent 2:4 dinitrophenol. Within seven hours definite lenticular opacities were noted in each eye of all the chicks. The opacities were limited to the anterior and posterior subcapsular regions. The cataracts regressed to a considerable degree even while the drug was still being administered. White mice and congenitally obese yellow mice failed to develop cataracts under the same conditions.

John C. Long.

Cassidy, J. V., and McFarland, C. B. Arachnodactyly (Marfan's syndrome) associated with ectopia lentis. *Amer. Jour. Ophth.*, 1947, v. 30, April, pp. 469-474. (19 references.)

Cordes, F. C. Types of congenital cataract. *Amer. Jour. Ophth.*, 1947, v. 30, April, pp. 397-420. (24 figures, 84 references.)

Decker, P. H. A method of closing the cataract incision by combining a corneoscleral suture and a large sliding

conjunctival flap. *Trans. Amer. Acad. Ophth.*, 1947, Jan.-Feb., pp. 210-213.

The author successfully uses the following technique to secure adequate approximation and sealing of the incision in 125 operations. The conjunctiva is circumcised as in enucleation over the upper three fifths of the limbus and undermined sufficiently to prevent tension. With a 6-0 black silk suture, a horizontal corneoscleral mattress suture is inserted and tied after the completion of the operation. The conjunctival flap is then brought down over the upper half of the cornea and held in place with two sutures. These sutures are removed on the fourth day and the corneoscleral suture on the twelfth.

Chas. A. Bahn.

Disler, N. N. Three cases of injury of the lens without subsequent cataract formation. *Vestnik Oft.*, 1946, v. 25, pt. 4, pp. 40-41.

In the course of development of traumatic cataracts, Disler observed peripheral, subcapsular, round or elongated vacuoles not connected with the perforation in the lens capsule. They are the first sign of an impending opacification of the area; they indicate a progressive hydration of the tissue and inescapable opacification. Gradually the groups of vacuoles and the number in each group increases. They become confluent and form a continually extending ring in the lenticular periphery, which joins other areas of hydration and opacification. Disler also had under observation three injuries of the lens, in which these peripheral opacities were absent. All three remained without the development of cataract for the three years. One lens had a glass splinter partially imbedded in it. The other lens was perforated by a piece of copper

which lodged in the vitreous; the third lens contained a fine transparent foreign body in its superior inner quadrant. Disler infers that in trauma of the lens the peripheral vacuoles are of prognostic significance.

Ray K. Daily.

Galois, A. Cataract extraction with keratome incision. *Ann. d'Ocul.*, 1946, v. 179, Sept., pp. 492-497.

The use of a keratome instead of a Graefe knife for cataract extraction is advised to avoid increased delayed healing and iris prolapse. A keratome incision is suggested which is so large that enlargement with scissors is not necessary. The technique described has been used by the author in 250 cases during a period of eight years. This is essentially the technique suggested by Duverger and Velter. In operating on the left eye a suture through the external rectus is used for fixation; on the right eye, a suture in the internal rectus. The conjunctiva is dissected down to the limbus. With a large keratome a limbal incision is made several mm. to the left of the vertical meridian. The keratome is passed as far into the anterior chamber as possible and in its withdrawal the section is enlarged by means of the lateral cutting edge on one side. A total iridectomy is performed. If the lens capsule is very tense due to lens intumescence a very small puncture with the cystotome is made in the capsule near the equator preliminary to intracapsular extraction. Nasal and temporal scleral corneal sutures are used.

Chas. A. Bahn.

Henkes, H. E. On the distribution of glutathione and vitamin C in the lens and cornea. *Ophthalmologica*, 1946, v. 112, Sept., pp. 113-128. (See Section 6, Cornea and sclera.)

Maestro, Tullio. The ascorbic acid content of the cornea. *Rassegna Ital. d'Ottal.*, 1941, v. 10, Sept.-Oct., pp. 487-500.

Eighteen white rats were fed upon a diet deficient in vitamin A. The oxidation of the fatty acids and their esters was studied and the results were related to the changes in human cataractous lenses. The respiration of the opaque human lens is raised by the fatty acid esters. The present researches confirm the finding of this oxidation in the lens, which has been previously demonstrated in many other tissues. Butyric acid was shown to be especially active upon the cataractous lens fibers. Eugene M. Blake.

Nicolato, A. Two hundred cases of intracapsular cataract extraction. *Rassegna Ital. d'Ottal.*, 1942, v. 11, Jan.-Feb., p. 3.

Intracapsular and extracapsular extraction of cataract are compared. The necessity for careful study of each eye is stressed, so that the attempt to remove the cataract in its capsule will not fail. The author feels that the intracapsular method gives better results in every way and that late complications are less frequent than with the classical procedure. Eugene M. Blake.

Villa-Coro, A. Optic nerve atrophy after a cataract operation. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Sept., pp. 901-904.

The importance of this work is to suggest the incidence of optic nerve atrophy after a cataract operation when the atrophy has no other cause. After 5,000 cataract operations the author found that 10 of these patients developed optic nerve atrophy.

J. Wesley McKinney.

10

RETINA AND VITREOUS

Arruga, H. The simultaneous detachment of the choroid and the retina after a cataract operation. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Feb., pp. 119-125. (See Section 9, Crystal-line lens.)

Bailliant, P. Circulation of the retina and general medicine. *Wien. Klin. Wchnsch.*, 1946, v. 58, June; pp. 332-337.

The observation of the retinal circulation is becoming more and more important for specialists and for general physicians. The oculist sees in the retinal vessels the basis for the retinal nutrition, the neurologist pictures in them the state of the cerebral vessels, the physiologist and general physician finds in them clues to the behavior of the peripheral circulation which is responsible for the life of the cell and influences the general blood pressure. We are able to measure the pressure of retinal arteries and veins, can measure their thickness, can observe the circulation of the blood corpuscles, can estimate the elasticity of their walls and can even photograph them. Because strong drugs changed the caliber of the vessels only little and the existence of vasomotor nerves in both cerebral and retinal vessels has been denied, it was assumed that the general blood pressure was the responsible factor for the pressure in these organs. Stimulation and excision of the nervous elements of the carotid sinus showed that the pressure changes in the retinal arteries do not correspond to the general blood pressure. The caliber of the retinal vessels is no longer important. In its place we emphasize the local pressure measured by the dynamometer. The circu-

lation in a given area varies according to its activity at any given time. The exchange of the substances necessary for the metabolism of the cells is variable and is regulated by changes in the tonus and not by changes in the caliber of the vessel wall. If the tonus increases, the blood pressure increases in this area. A spasm of the peripheral vessel is not normal and is the exception. If the tonus of an artery decreases, the pressure does not only sink in the artery, but in the capillaries and veins of the area as well. Increased peripheral pressure decreases the blood supply of the area through increased resistance. The blood pressure, as it is measured consists of the true pressure plus the tension of the blood vessel wall. The latter is relatively insignificant in an artery with a thin muscular wall, but is significant in the retinal arteries. It is the tonus of the wall which keeps up the circulatory pressure and counteracts the effect of gravity, it is this tonus which varies with excitement, which may cause higher or lower local pressure in cases of generalized hypertension or which may slow down the local circulation to complete interruption. Retinal hemorrhages may or may not be associated with general hypertension. Hemorrhages may be an expression of localized hypotony as in pernicious anemia. It is too often forgotten that the blood vessels themselves are composed of cells and that they themselves undergo pathologic changes. At first these diseased cells only cause a disturbance of the normal metabolic interchange, later they may disintegrate and permit the exit of blood from the vessel. A degeneration of the cells of the whole vessel wall leads to obliteration. In the case of end arteries like those in the brain and in the retina such obliteration means sudden func-

tional death, which, unless the obliteration is quickly relieved, becomes permanent. Embolism in the retinal arteries and venous thrombosis and their consequences in the retina are also described. Max Hirschfelder.

Baquis, Mario. Retinal hemorrhages from strain. *Rassegna Ital. d'Ottal.*, 1941, v. 10, July-Aug., pp. 417-437.

Baquis defines overwork, or strain as an activity of a working individual surpassing physiological limits in intensity or duration. The strain may be physical or psychic, muscular or mental. Three cases of sudden loss of vision due to hemorrhages of the retina which followed excessive muscular effort are described. E. M. Blake.

De Leonibus, F. The ability of the normal lens to survive the oxidation of some amino acids. *Rassegna Ital. d'Ottal.*, 1941, v. 10, Nov.-Dec., pp. 547-556.

De Leonibus reports briefly upon our present understanding of the metabolism of the amino acids, with particular regard to the researches upon the influence of these substances upon the retina. The method of Warburg was further employed to study the relation of the amino acids to the lens in concentrations of M/100, at pH of 7.2. The results were not conclusive. Certain of the amino acids increased the respiration of the lens, and others decreased this property. Apparently the amino acids play a minor role in the metabolism of the lens. Eugene M. Blake.

Ershkovich, I. G. Tissue therapy in traumatic changes of the vitreous during the World War. *Vestnik Oft.*, 1946, v. 25, pt. 1, pp. 16-20.

This study is based on 20 cases of vitreous opacity following war injuries,

14 of which were perforating and six contusions. In two eyes intraocular foreign bodies were extracted, and six contained nonmagnetic foreign bodies. Half of the injured had additional injuries of the face, chest, and extremities. In eleven patients there was a dense organized exudate encapsulating a foreign body and in five of them the retina was detached. In seven there was a hemophthalmos, and in two retinitis proliferans. Of the twenty patients three had only one eye, and one had both eyes injured. Tissue therapy was instituted one to nine months after the injury. In 10 patients tissue therapy was combined with osmotherapy and autohemotherapy. There was improvement in 18. The favorable effect was observed in six eyes containing an intraocular foreign body, and in six with retinal detachment. The author urges a trial of this therapy in eyes regarded as hopeless. Ray K. Daily.

Ferrié, J. Macular lesions of degenerative appearance and their relation to tuberculosis. *Ophthalmologica*, 1946, v. 112, Sept., pp. 135-148.

For a number of years the author has been especially interested in the distinction between inflammatory and degenerative macular lesions. In 1941, together with Lafont, he presented before the ophthalmological Congress of Southern France (Montpellier, June, 1941) a study of Stargardt's disease associated with a neurologic syndrome of the order of Friedreich's ataxia. Of this combination of hereditary macular and neurologic disease, Ferrié now reports two cases (father and daughter) with typical macular lesions of the Stargardt type but definite evidence of congenital syphilis. Ferrié then describes and depicts in color a bilateral chronic macular disease of typically degenerative ap-

pearance in four adults with definite evidence of active or arrested pulmonary tuberculosis. The author's ophthalmoscopic criteria of degenerative macular disease appear to be the same as those used in English-speaking countries. Rather cautiously and without any definite evidence other than the coexistence of the two conditions he suggests a tuberculous etiology of macular lesions of degenerative appearance in definitely tuberculous adults.

Peter C. Kronfield.

Givner, I., and Bruger, M. Associated systemic factors in retinitis pigmentosa. *Arch. of Ophth.*, 1947, v. 37, March, pp. 261-267.

This study was prompted by two cases of retinitis pigmentosa with unusual associated conditions. An attempt to determine whether these additional factors were constantly present led to laboratory investigations, of which this paper is a preliminary report. The present series includes 14 patients.

The unusual feature of one case was a spinal fluid pressure of 300 mm. of water. In the other patient the spinal fluid was under normal pressure, but the total protein measured 194 mg. per hundred c.c. (normal 15 to 40 mg.) and the chlorides 1,195 mg. per hundred c.c. (normal 700 to 750 mg.). In addition, the basal metabolic rate was 17 percent below the average and creatinuria was present.

No abnormalities in pulse rate, blood pressure or temperature were observed in 14 patients with retinitis pigmentosa. The serum cholesterol was within normal limits. The basal metabolic rate was within or below normal limits. Eleven patients had creatinuria. Spinal fluid pressure and total protein content of the spinal fluid was definitely

increased. Hepatic damage was not demonstrable. The fasting ascorbic acid content of the plasma was reduced in seven of nine patients on whom this determination was carried out. Vitamin A studies on the serum of seven patients gave normal values.

In 11 patients pupillographic studies showed tonohaptic reactions and other evidences of diencephalic disorders. Tests failed to reveal any measurable impairment in renal function in 13 patients. Physical examination, including neurologic studies, gave essentially normal findings except for the high incidence of high-arched palate and nerve deafness. R. W. Danielson.

Goldfeld, R. G. Tissue therapy of fundus changes with hole in the macula due to contusions. *Vestnik Oft.* 1946, v. 25, pt. 1, pp. 24-26.

Three of four eyes with traumatic hole in the macula treated by tissue therapy were improved. The improvement is attributed to the absorption of edema and exudate in the parimacular area. It is suggested that all patients with such injury be given the benefit of this therapy. Ray K. Daily.

Hallum, Alton V. Retinal arterioles in the hypertensions of pregnancy. *Trans. Amer. Ophth. Soc.*, 1945, v. 43, pp. 585-607.

Hallum offers a classification of retinal arteriolar spasm in toxemia of pregnancy, based on the degree of retinal arteriolar spasm. He considers its evaluation a distinct aid in determining if, and when, pregnancy should be terminated. C. D. F. Jensen.

Jordano Barea, Jose. Localization of the tears in an operation for detached retina. Thermoluminous caliper meth-

od. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1945, 5, Dec., pp. 1130-1136.

The instrument consists of an ophthalmoscope to which is added a metallic arm. Into this is placed a long curved electrode. Thus, one has a caliper whose intraocular arm is the light projected by the ophthalmoscope and the extraocular arm is formed by the electrode. The electrode marks the place of the tear on the sclera. (6 illustrations.) J. Wesley McKinney.

Jordano Barea, Jose. Thermoluminous caliper method for localization of the tears in detached retina. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Feb., pp. 203-208.

In a previous article published in this journal in December, 1945, the author describes his method of the thermoluminous caliper. Now he gives further advice about its use.

J. Wesley McKinney.

Maestro, Tullio. Changes in the retinal arterial pressure in a patient suffering from a paralysis of the cervical sympathetic nerve. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, Nov.-Dec., pp. 413-421.

A 30-year-old married woman developed a typical Claude Bernard-Horner syndrome two days after an injection had been given into the thyroid gland. The intraocular pressure remained equal in both eyes during four months, but the diastolic arterial pressure stayed higher in the eye on the side of the sympathetic lesion for about two months. The differences in pressure varied from 5 to 10 millimeters when measured with the ophthalmodynamometer of Bailliart. The ptosis, miosis, and enophthalmos did not disappear when the diastolic arterial pressure became equal in both eyes. During

this time, no changes in the retinal vessels could be seen. K. W. Ascher.

Niven, C., Jr., Washburn, M., and Sperling, G. Growth retardation and corneal vascularization with tyrosine and phenylalanine in a purified diet. *Proc. Soc. Exper. Biol. and Med.*, 1946, v. 63, Oct., pp. 106-108.

The addition of 1 percent DL-phenylalanine and 1 percent L (-) tyrosine to a purified diet containing 10 percent casein produced growth retardation and external lesions. Phenylalanine is converted to tyrosine in the animal and so may add to the effect of the tyrosine. The addition of relatively large amounts of nicotinic acid or L (-) tryptophane will appreciably alleviate the deleterious effects of these amino acids. Theodore M. Shapira.

Pereyra, Lorenzo. Coats' disease. *Riv. di Oftalm.*, 1946, v. 1, July-Aug., pp. 489-509.

The author reports a clinical study of two cases of bilateral Coats' disease and a histologic study of one eye that was enucleated because of decompensated glaucoma. Vascular, degenerative, and proliferative lesions were encountered histologically. The most impressive vascular lesion consisted of an enormous dilatation of the choroidal network; the thickness of the choroid was five times that of the normal membrane. The retinal vessels, on the other hand, were constricted, even partly occluded, and showed thickening of their walls. Degenerative changes were found in the retina, particularly in those layers adjacent to the exudate which was found between the choroid and the retina and which, on chemical examination, showed a high globulin content. Proliferative lesions found in

the retina faintly resembled a glioma which, however, was excluded by the absence of atypical cells and by the relative preservation of the retinal cytoarchitecture. The transudate located between the choroid and the retina was believed to originate from the enormously dilated and permeable choroidal vessels; the essence of this lesion was assumed to be a malformation, an angiomatosis belonging to the group of hamartomas. A hypoplasia of the choroidal vessel walls seemed to be the primary cause of the dilatation of these vessels and of the enormous transudation which interfered with the normal nutrition of the retinal tissue. The remissions which were observed in many eyes affected by Coats' disease as well in those described by the author, may well be explained by temporary resorption of a part of this transudate. A relationship to Hippel-Lindau disease is mentioned. (Bibliography, 10 photomicrographs.) K. W. Ascher.

Pokrovsky, A. I. The pathogenesis and therapy of retinal detachment of tuberculous origin. *Vestnik Oft.*, 1946, v. 25, pt. 6, pp. 17-20.

The clinical history of a patient is reported to show that in the presence of tuberculous chorioretinitis a slight trauma may lead to retinal detachment with a hole which simulates idiopathic detachment. The presence of a retinal tear is an indication for diathermy coagulation, but a favorable surgical result should not lead to the neglect of general therapy including tuberculin therapy. Ray K. Daily.

Samoilov, A. I. Retinal edema in tuberculous diseases of the anterior ocular segment. *Vestnik Oft.*, 1946, v. 25, pt. 6, pp. 20-25.

Case reports illustrate the occurrence of retinal edema complicating anterior uveal tuberculosis without choroidal involvement. The low visual acuity sometimes found in anterior uveitis may be due to the retinal edema. Calcium iontophoresis is valuable diagnostically in diminishing the edema, and consequently the size of the scotoma. Calcium iontophoresis is a valuable desensitizing measure, and also a therapeutic procedure for diminishing the edema and restoring function. Further investigations will show whether the retinal edema represents a specific tuberculous process in anterior uveitis, or may occur in similar processes of other etiology. Ray K. Daily.

Sandomirsky, L. A case of Purtscher's retinopathy. *Vestnik Oft.*, 1946, v. 25, pt. 4, pp. 44-45.

A soldier was struck in the occipital region with a heavy piece of wood, and the following morning he noticed loss of vision in the left eye, which was found to be due to Purtscher's retinopathy. The loss of vision was permanent. The literature on this rare condition is reviewed. (Illustration.)

Ray K. Daily.

Skorodinskaja, V. V. The treatment of retinitis pigmentosa with extract of leaves of aloes. *Vestnik Oft.*, 1946, v. 25, pt. 1, pp. 9-12.

This clinical study done at Tashkent comprises 12 cases. Nine adults and three children were studied. Eight of the 12 patients had impairment of hearing. They had been treated with favorable results with intramuscular injections of cod-liver oil. During the war this was not available and the extract of leaves of aloes was given in 1 to 2 c.c. doses, daily or every other day, for 45 injections. In some cases tissue im-

plantation was also done. Extension of the visual field, increased visual acuity, or diminished hemeralopia were considered signs of improvement. Detailed reports show that improvement appears after the eighth to the thirteenth injection. The first sign of improvement was an extension of the visual field, visual acuity rose next, and adaptation was the last function to improve. The courses of treatment were repeated every two to three months, because at the end of the third month visual acuity fell again. In children the extract can be administered in the form of small enemas. The period of observation varied between 7 and 18 months. Whether the process could be permanently arrested cannot be determined from this study, but it is obvious that the effect of therapy is favorable. It manifests itself not only in the ocular function, but also in the general condition of the patient. Ray K. Daily.

Streiff, E. B., and Monnier, M. Influence of vestibular irritation on retinal arterial pressure and on general blood pressure. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, March-April, pp. 81-100.

The authors studied the changes produced by irrigation of the vestibulum of anesthetized rabbits and cats. Water at 45 to 50 and at 5 to 18 degrees centigrade was used, and the arterial pressure in the retina was measured. Another series of experiments was performed on cats with previously interrupted brain stem and cervical sympathetic tracts. Galvanic irritation of the bulla ossea was also used. Clinical observations were correlated with these animal experiments. During vestibular irritation a drop in both general and retinal arterial blood pressure was noted; after cessation of the irrita-

tion, the general blood pressure returned to normal and the retinal arterial pressure surpassed its original values ("hypertensive reaction"). This hypertensive reaction was not observed in animals in which the cervical sympathetic or the pontine tracts had been destroyed. (Extensive bibliography; schematic drawings of high didactic value).

K. W. Ascher.

Weeker, L. Adhesive episcleral reaction in the operative treatment of retinal detachment. *Brit. Jour. Ophth.*, 1946, v. 30, Dec., pp. 715-722.

Ordinary operative methods of treatment of detached retina aim primarily at the formation of an adhesive choroïditiſ at the site of the retinal tear. In studying the healing of knife punctures through the bulbar walls in rabbits, it was seen that the newly formed episcleral connective tissue penetrated through the sclera and became attached very firmly to the retina. The same condition prevailed in human eyes similarly penetrated before removal for various causes. The author believes that this adhesive episcleral reaction is essential for the permanent reattachment of the retina. It takes place irrespective of the method of perforation.

He describes an operation procedure that gives a satisfactory adhesive episcleral reaction. First the nonperforating diathermic electrode is applied to the sclera in the area of the tear. This serves to promote the usual adhesive choroiditis. Then a diathermy needle 2 mm. by 0.15 mm. with the least amount of current for easy perforation is used to puncture the tissues from 3 to 20 times. Lastly the sclera and choroid are punctured with an actual cautery point for the evacuation of subretinal fluid. (4 figures.)

Morris Kaplan.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Bushmich, D. G., and Getmān, V. P. Tissue therapy in optic atrophy. *Vestnik Oft.*, 1946, v. 25, pt. 1, pp. 20-24.

The introduction of methyl alcohol into the occupied areas by the German occupying forces led to a number of cases of methyl alcohol poisoning and optic atrophy. This clinical experience comprised 25 patients with an optic atrophy of from two months to two years duration. The majority of these patients had been treated without significant effect by means of blood transfusions, strychnine injections, and intravenous injections of sodium iodide. Because of the advanced stage of the process these patients were given several courses of combined tissue therapy in the form of implantation of preserved skin and placenta, intramuscular injections of cod-liver oil, subcutaneous injections of extracts of preserved leaves of aloes and placenta. The visual acuity and visual field for form and colors were checked every other day. Visual acuity improved in 17 cases, and the visual field in 14. In six patients with no light perception and in one with imperfect light projection there was no improvement. The period of observation extended from 4 to 18 months, and during this time the improvement was stable. While the improvement consisted only in several hundredths of visual acuity, the results are nevertheless considered encouraging because of the gravity of the process and because former therapy was ineffective. The better results reported by Bushmich in the treatment of traumatic optic atrophy suggest that perhaps early treatment before irreversible pathologic processes had time to develop might have been more effective.

tive. It is advocated that this form of therapy be administered within the first few days after the poisoning, with the object of stimulating the fermentation capacity of the tissues and eliminating the action of products of decomposition of methyl alcohol on the optic nerve.

Ray K. Daily.

Casari, G. F. Vitamin A test in the differential diagnosis of optic atrophy and chronic glaucoma simplex without manifest hypertension. *Rassegna Ital. d'Ottal.*, 1946, v. 15, July-Aug., pp. 305-314.

Casari made carefully controlled tests of the light minimum, the light difference, and color perception in cases of optic atrophy and probable early glaucoma. The patients were then given 600,000 units of vitamin A in oil orally. Patients affected with optic atrophy and with chronic glaucoma simplex present a definite disturbance of the light sense, with manifest hemeralopia. The use of massive doses of vitamin A improves the light sense in simple atrophy but has no affect in glaucoma, and therefore, may be used to differentiate between the two conditions.

Eugene M. Blake.

Gandolfi, C. Optic neuritis from focal infection. *Riv. di Oftalm.*, 1946, v. 1, July-Aug., 441-445.

A unilateral intraocular neuritis healed completely after removal of a granuloma of one molar tooth.

K. W. Ascher.

Maestro, Tullio. Choked disc "ex vacuo." *Riv. Oto-Neuro-Oft.*, 1943, v. 20, March-April, pp. 112-134.

A 12-year-old girl developed a unilateral choked disc in an eye with a severe tuberculous keratitis. When, after three months, the cornea had

healed and intraocular pressure had returned to normal, the disc regained a normal appearance. The mechanism of the papilledema and related conditions is extensively discussed and the conclusion is reached that three factors contribute to the development of the choked disc. An increase of the intra-venous pressure is the most important, and slowing of the venous flow and interference with the lymph return are the contributory causes. (Bibliography, 2 figures.)

K. W. Ascher.

Sanchez Martinez, L. The tumors of the frontal lobe. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Feb., pp. 170-189.

Two cases of frontal lobe tumor are reported. The first had simple optic atrophy in the left eye with marked concentric contraction of the peripheral field, absolute central scotoma and achromatopsia and in the right eye papilledema of six diopters, narrow arteries, large and tortuous veins, slight contraction of the peripheral field and enlargement of the blind spot. A diagnosis of a tumor of the left frontal lobe was made. The second case was one of tumor of the right frontal lobe. There was bilateral papilledema of five or six diopters, the disc was covered with exudate and hemorrhagic dots, the arteries were narrow and the veins large and tortuous. There was slight concentric contraction of the peripheral fields with enlargement of both blind spots. (Illustrations.)

J. Wesley McKinney.

12

VISUAL TRACTS AND CENTERS

Brockman, N. W., and Van Hagen, K. O. Denial of own blindness (Anton's syndrome). *Bull. Los Angeles Neurol. Soc.*, 1946, v. 11, Sept.-Dec., pp. 178-180.

Patients who deny blindness usually present considerable intellectual deterioration, impairment of memory, disorientation and confabulation. There is complete blindness apparently due to bilateral involvement of the optic lobes or optic radiations. The pathogenesis of this condition is incompletely understood, but appears to be due to a disturbance in the to and fro circuits between the thalamus and the occipital cortex. Two typical cases are reported.

O. H. Ellis.

Caramazza, F. Meningioma of the tuberculum sellae. *Riv. Oto-Neuro-Oft.*, 1943, v. 20, Jan.-Feb., pp. 1-18.

A woman, 32 years of age, noticed fogged vision in her left eye in 1939. Her right pupil was slightly larger. Both discs were pale. Disc borders, retinal vessels, and retinal vascular pressure were normal. Vision of the right eye was 10/10. The left eye counted fingers at 30 centimeters only. Visual field examination revealed a right homonymous hemianopsia, no central scotoma on the right field and a definite left central scotoma. Neurologic and laboratory findings were negative; radiography of the skull revealed anteroposterior enlargement of the sella (X-ray photographs), small anterior and posterior clinoids, normal optic canals, and no signs of increased intracranial pressure. Encephalographic findings were negative. Surgery revealed the presence of a meningioma of the tuberculum sellae, flattening of the compressed left optic nerve and discoloration of the right optic nerve. The right eye retained vision of 10/10. The difficulties of the preoperative diagnosis were due to the lack of encephalographic findings typical for the Cushing meningiomas.

K. W. Ascher.

Colaciuri, Vittorio. Neurochiasmatitis of vascular and of meningeal origin. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, Nov.-Dec., pp. 357-381.

This is a histologic study of the inflammatory lesions in and about the optic chiasma of eight patients, suffering from syphilitic (5 cases), tuberculous, and an unknown meningocerebral disease and disseminated sclerosis. The syphilitic lesions showed increased interstitial connective tissue, hyperplasia, and new formation of blood vessels, scanty myelin degeneration and rarefaction of the axis cylinders. Few changes were seen in the glia and in the leptomeninges. These latter structures showed definite alterations in the three patients with nonsyphilitic disease; myelin degeneration and axis cylinder rarefaction were also present. The author suggests means to differentiate neurochiasmatitis of vascular origin from meningeal. (12 photomicrographs; 11 references.)

K. W. Ascher.

Frantz, Russell, and Vogel, P. J. Visual hallucinations as localizing manifestations of lesions of the temporal and occipital lobes. *Bull. Los Angeles Neurol. Soc.*, 1946, v. 11, Sept.-Dec., pp. 135-144.

The authors present two cases in which visual hallucinations, one of color and the other of highly organized animate objects (on one occasion colored), were present and seemed to have a localizing value. A review of the recent literature calls attention to widely divergent opinions as to the significance of visual hallucinations in localization.

O. H. Ellis.

Fortunato, Francesco. Ocular signs produced by cysts of the pouch of

Rathke. *Riv. Oto-Neuro-Oft.*, 1943, v. 20, March-April, pp. 69-93.

One year after a marked diminution of his sexual functions, a 36-year-old man noticed visual disturbances and general exhaustion. In the course of the next two years he gained 11 kilograms in weight, suffered from headaches, pain in his neck, paracusis, flickering in his left eye, weakness of his legs, incontinence, vomiting, and one attack of generalized convulsions. Neurological findings were normal except for a slight diminution of his olfactory and gustatory senses. Vision was 5/60 in the left and 9/10 in the right eye; the visual field of the left eye was constricted for colors in its lower half, and showed a large (20 degrees) central scotoma, the field of the right eye had a relative central scotoma for colors. The left disc was surrounded by edema and its temporal half was pale; the right disc showed an incipient papilledema. The sella was enlarged and its borders markedly destroyed. A craniopharyngioma was diagnosed, and partly removed. After the operation, the atrophy of the optic nerves proceeded and vision deteriorated. A Cushing decompression operation was performed two months after the first intervention. The final vision was 4/60 in the right eye, and amaurosis in the left eye. (6 figures, bibliography.) K. W. Ascher.

Pedico, O. Chronic serous meningitis. *Rassegna Ital. d'Ottal.*, 1946, v. 15, July-Aug., pp. 319-333.

Pedico emphasizes that chronic serous meningitis is frequently confused with brain tumor, especially in the chiasmatic region, and that the ophthalmologist is often the first physician to be consulted. Such cases may assume medicolegal importance and are espe-

cially important in an ambulant soldier whose chief complaint is severe head pain. The papilloedema, the skull radiograph, and the type of cephalalgia are the chief factors in diagnosis. In the case described the ophthalmodynamometer of Bailliar demonstrated increase of intracranial pressure.

Eugene M. Blake.

Rubino, A. Chiasmal syndrome associated with endocraniosis hyperostotica (Morgagni). *Riv. Oto-Neuro-Oft.*, 1942, v. 19, March-April, pp. 101-132.

Two patients are described. The disease, which was first mentioned by Morgagni (1765) is best named hyperostosis frontalis interna. Rubino considers an opticochiasmatic arachnoiditis to be the main pathogenetic factor and neurohypophyseal complications should be explained as sequelae. Circulatory disturbances are a predominant feature of the syndrome, and were obvious, in Rubino's patients, ophthalmoscopically as well as roentgenologically. (13 illustrations, bibliography.)

K. W. Ascher.

13

EYEBALL AND ORBIT

Azzolini, Umberto. Anterior noncommunicating encephalocystocele. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, Sept.-Oct., pp. 338-350.

An 11-months-old male infant had an anterior encephalocystocele as large as his fist which increased during crying. It was reducible by pressure during the first weeks of life, but not later. It was situated between the right ethmoid and frontal bones and contained cerebrospinal fluid. The author assumes that the encephalocystocele lost its communication with the subarachnoidal space because of an inflammatory proc-

ess, probably congenital syphilis. Only four similar cases have been described previously (Bibliography, 3 illustrations.) K. W. Ascher.

Cadili, G. Osteoma of the maxilla with encroachment on the orbit. *Riv. di Oftalm.*, 1946, v. 1, July-Aug., pp. 459-472.

Partial removal of a maxillary osteoma reduced the disfiguring exophthalmos without interfering with the function of the eye. (4 figures, bibliography.) K. W. Ascher.

Courville, C. B., and Schillinger, R. J. Intracranial complications of the eye and orbit. *Bull. Los Angeles Neurol. Soc.*, 1946, v. 11, Sept.-Dec., pp. 102-110.

In a series of thirty thousand autopsies the authors found only one proven case of orbital actinomycosis that had caused secondary intracranial complications. Malignancies can extend along the optic nerve or erode intracranially. Trauma may simultaneously involve the orbit and cranial cavity. Infections and granulomas of any origin may invade the intracranial cavity and cause septic meningitis or thrombosis of the cavernous sinus. However, the rare orbital tuberculomas or syphilomas almost never extend intracranially.

O. H. Ellis.

Godtfredsen, Erik. Ophthalmoneurological symptoms in connection with malignant nasopharyngeal tumours. *Brit. Jour. Opth.*, 1947, v. 31, Feb., pp. 78-100.

Malignant nasopharyngeal tumors are of fairly rare occurrence, but are more frequent in males. Ophthalmologic symptoms are often present. These symptoms occur chiefly in the period when the exact diagnosis has

not yet been made, but the ophthalmologist should be able to diagnose them correctly. The eye symptoms in decreasing order of frequency were sixth nerve paresis, paresis of the third nerve, visual pathway lesions, paresis of the fourth nerve, Horner's syndrome and exophthalmos. The ophthalmoplegias generally manifested themselves as massive paralyses with associated clinical findings. The visual pathway lesions presented various degrees of severity from a slight impairment of vision to the more frequent total amaurosis with atrophy of the optic nerve or choked disc. Local rhinologic and otologic symptoms occur and large metastatic cervical glands appear early.

Intensified irradiation produced a remarkable percentage of five year cures. (16 illustrations.) O. H. Ellis.

Juzefova, F. I. Experimental investigations on the pathogenesis of metastatic ocular tuberculosis. *Vestnik Oft.*, 1946, v. 25, pt. 6, pp. 7-13.

This is a report of a detailed study on guinea pigs. There were three series of experiments. In one a culture of tubercle bacilli was introduced into the vascular system of the guinea pig; in some of them one eye was subjected to trauma. In another series the guinea pigs were sensitized to horse serum by repeated injections. The final dose was introduced into various tissues of the eye. A culture of tubercle bacilli was introduced into the blood at the same time. A third series, for control, was only sensitized to horse serum. In the first series a high immunologic state of the ocular tissues resulted. Only one of the nine animals developed a tuberculous choroiditis; apparently the trauma was ineffective. In the sec-

ond series 18 out of 20 animals developed a nodular tuberculosis at the site of the last traumatizing injection and in the iris. In the nontraumatized eyes the tuberculous process involved the choroid. These findings demonstrate conclusively the role of the preliminary sensitization in the development of ocular tuberculosis. The hypersensitivity which favors the development of tuberculosis need not be a tuberculous allergy. The ocular lesions of the animals of the third series had no specific character.

Ray K. Daily.

Kisner, W. H., and Mahorner, H. **Unilateral exophthalmos: an early sign in thyrotoxicosis.** *Surg. Gyn. and Obstet.*, 1947, v. 84, March, pp. 326-331.

As an early sign of hyperthyroidism, unilateral exophthalmos is not rare. It may be the only sign of incipient toxic goitre and may precede by months all other subjective and objective findings. Vascular lesions and tumors are the most frequent causes for unilateral exophthalmos.

According to Cavity this condition is sometimes confused with upper lid retraction (Dalrymple's sign). Again there may be bilateral proptosis but the fact that both eyes share in this sign is not recognized. Cavity reported three cases where this sign was the first sign in Graves' disease and the diagnosis was not established until 6, 8, and 20 months had elapsed.

The authors discuss the cause, pathology, treatment, and some experimental work on exophthalmos. They feel that there is little doubt that in some cases of Graves' disease the immediate effect of thyroidectomy is unfavorable. Many weeks or months later the process subsides and usually the eyes return to normal. Radical pro-

cedures such as the Naffziger operation should be deferred for as long as two years after thyroid removal.

Francis M. Crage.

Kogan, N. D. **Fire-arm injuries of the orbit.** *Vestnik Oft.*, 1945, v. 24, pt. 4, pp. 11-15.

On the basis of a clinical experience with 48 orbital wounds Kogan concludes that the gravest injuries are the orbitocranial or those involving the sinuses. Orbital injuries should have a roentgenologic as well as a neurologic examination. In isolated perforating ocular injuries one should keep in mind the possibility of a double perforation with penetration of fragments into the skull, and subsequent neurologic complications. Surgical intervention should be a joint task of the ophthalmologist, rhinologist, and neurosurgeon. Provision of ophthalmologic service at the front or prompt transport of the wounded to specialized hospitals is the best prophylactic measure against complications and death.

Ray K. Daily.

Longhena, Luisa. **Cranio-orbital fracture complicated by diplococcic meningitis.** *Riv. Oto-Neuro-Oft.*, 1943, v. 20, March-April, pp. 94-111.

An apparently slight injury to the orbit suffered during an air raid was followed by a fatal meningitis. Purulent posttraumatic meningitis usually results from an infection that penetrates through a cranial fracture into the subarachnoidal space. Often, the first meningeal signs appear before the surgeon realizes that there is a bony lesion. Even without infection in the accessory nasal sinuses, a severe meningitic complication may follow the injury, due to the presence in the normal

mucous membranes of a varied bacterial flora. Negative nasal examination and initially good condition of the patient do not warrant a favorable prognosis. Injury to the dura and to the brain proper increases the danger. (2 figures, bibliography.)

K. W. Ascher.

Marin Amat, M., and Diaz Gomez, E. Exophthalmos in orbitocranial tumor. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Feb., pp. 190-202.

A 24-year-old woman with a marked exophthalmos of the left eye had pallor of the optic disc, large and tortuous veins, and slight concentric contraction of the peripheral field in the left eye and slight pallor of the papilla with enlarged veins and temporal hemianopsia in the right. A diagnosis of orbitocranial tumor was made. The operation showed that the exophthalmos was due to a tumor mass of the cranial cavity that had spread to the orbit. (6 illustrations.) J. Wesley McKinney.

Marucci, L. Bilateral exophthalmos of unequal degree. *Rassegna Ital. d'Oftal.* 1941, v. 10, Sept.-Oct., pp. 527-538.

Slight bilateral exophthalmos occurred in a man, 38 years of age. Periodically there was an increase in the proptosis and some edema of the lids, hyperemia of the conjunctiva, but no feeling of distress. The author concludes that there is an intraorbital angioma, with a neurovascular lability, that results in an augmentation of the exophthalmos of the right eye. Roentgen radiation brought about a satisfactory result, both as to the exophthalmos and the crises. E. M. Blake.

Mastrangeli, Wilfredo. Tuberculoma of the orbit. *Riv. di Oftalm.*, 1946, v. 1, July-Aug., pp. 446-458.

Di Marzio distinguishes the following types of orbital tuberculosis: secondary to tuberculous disease of the eyeball; extension from the orbital bones or accessory sinuses of the nose; isolated orbital tuberculosis; symmetrical tuberculosis of both orbits. In a woman, 58 years of age, a tentative diagnosis of orbital tumor led to removal of a tumor measuring 3 by 1 centimeters. Histologically, a miliary hyperplastic tuberculosis was diagnosed (two microphotographs). The Pirquet reaction was strongly positive, and an X-ray examination showed residual unilateral pleuritis. Not infrequently an orbital tuberculoma may be mistaken for a neoplasm. K. W. Ascher.

Olivella, Antonio. Intermittent exophthalmos. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Sept., pp. 905-912.

A case of a young man is reported, who within a year developed an intermittent exophthalmos of the left eye. A detailed clinical study showed that the exophthalmos was due to an orbital varicocele. J. Wesley McKinney.

Renard, G., and Offret, G. Angiomas of the orbit. *Arch. d'Ophth.*, 1946, v. 6, no. 3, pp. 284-313.

Orbital angiomas are more common than is generally realized and removal is necessary in the majority of instances. Surgical removal in toto is the only logical procedure.

Cavernous angioma is the most common anatomic form. It is a well-defined tumor of variable size and location with a tendency to localize near the inner wall of the orbit. The tumor commonly displaces the globe forward and laterally and may deform it by pressure inducing ametropia. Radiographic study shows enlargement of the orbit on the affected side. The authors call

attention to the fact that symptoms of angioma commonly appear in childhood but do not become incapacitating until adult life. Although these tumors are usually removable without difficulty, in exceptional instances adhesions to the extraocular muscles have occurred. Complications of operation include ptosis, oculomotor paralyses, anesthesia of the cornea, and optic atrophy. The authors describe in detail the microscopic anatomy of cavernous hemangioma, defining three anatomic types, cystic angioma, angioliipoma, and hemolymphangioma.

Simple angioma, while less common, is more variable and is capable of greater extension. It frequently extends beyond the orbit and is associated with nevus flammeus of the lids and of the face. Simple angioma has no capsule and tends to infiltrate widely in the orbit, menacing the integrity of all the intraorbital structures. Its surgical removal is difficult and is often followed by hemorrhage and sensory and motor disturbances. The histopathologic characteristics of this tumor are also described in detail.

In a discussion of the pathogenesis of orbital angioma the authors note its congenital nature and the lack of any hereditary or definitely predisposing factors. Phillips Thygeson.

Schneider, J., and Frankel, S. S. Treatment of late postoperative intraocular infections with intraocular injection of penicillin. *Arch. of Ophth.*, 1946, v. 37, March, pp. 304-307.

In two patients extracapsular cataract extraction was followed by late intraocular infection and was treated with intraocular injections of penicillin. In each case final vision was light perception.

The authors conclude that the intra-

ocular injection of penicillin for late postoperative infections is well tolerated by man and the eye may be saved from evisceration by early injection of penicillin. R. W. Danielson.

Shmeleva, Z. G. Some characteristics of ocular tuberculosis in the postwar period. *Vestnik Oft.*, 1946, v. 25, pt. 6, pp. 25-28.

Thirty-two patients with metastatic ocular tuberculosis were treated with tuberculin, and 12 with nonspecific therapy. An analysis of the material in comparison with prewar patients shows a shift towards an older group of patients, a greater general and local sensitivity, and a tendency to punctate hemorrhages, sometimes as focal reactions. These new tendencies in the clinical course call for greater caution in tuberculin therapy, and for the combination of this form of therapy with general hygienic and supportive measures. Ray K. Daily.

Stallard, H. B. A plea for lateral orbitotomy (Krönlein's operation). *Brit. M. J.*, 1947, March 29, pp. 408-409.

The Krönlein operation is preferred to the transfrontal technique in the removal of a neoplasm the physical signs of which show it to be entirely within the orbital cavity. There is more direct and adequate exposure. A case of a neurofibroma situated within the muscle cone, which was missed by the transfrontal approach is presented.

Irwin E. Gaynon.

Talkovsky, S. I. Ophthalmic symptoms of aneurism of the internal carotid in anophthalmos. *Vestnik Oft.*, 1945, v. 24, pt. 4, pp. 23-26.

Talkovsky saw four fire-arm injuries, with the point of entry at the temple, and exit from the orbit, followed by

destruction of the eyeball, and the development of an arteriovenous aneurysm of the internal carotid. The anophthalmos and the consequent absence of a pulsating exophthalmos obscured the presence of the aneurysm; the only symptom that arrests attention is the persistent edema and swelling of the soft tissues that results from the venous congestion of the orbit. The diagnosis is important because an attempt to enucleate the remains of the eyeball may lead to fatal hemorrhage. These patients need special vocational guidance, because even insignificant trauma may result in serious complications.

Ray K. Daily.

Weizenblatt, S. Penicillin in treatment of acute endophthalmitis. *Arch. of Ophth.*, 1946, v. 36, Dec., pp. 736-738.

A man, 49 years of age, had Elliott's trephine operations in each eye five years ago for chronic glaucoma. Six months later the right eye was lost because of infection with *Staphylococcus aureus*. The left eye had had three previous infections from which it recovered. A fourth infection, caused by *Staphylococcus albus* developed in April 1945. There was a purulent infiltration of the bleb, hypopyon and yellow reflex behind the lens. Treatment consisted of atropine, instillation of penicillin drops (2,500 units per c.c.) every hour, the oral administration of sulfadiazine, penicillin intramuscularly in 20,000-unit doses every four hours, and typhoid vaccine intravenously. Under this regimen the eye became worse. Two-tenths cubic centimeter of penicillin solution (2,500 units per c.c.) was injected into the vitreous. About 24 hours later glaucoma developed and atropine was discontinued. Practically complete recovery resulted, with normal pressure and vision of 20/20. Re-

peated infections of the bleb did not result in formation of scar tissue but lead to thinning of its conjunctival covering, which ruptured spontaneously.

John C. Long.

14

EYELIDS AND LACRIMAL APPARATUS

Arisi, Ebe. Morphologic study of the bony lacrimal fossa and lacrimal duct. *Rassegna Ital. d'Ottal.*, 1946, v. 15, July-Aug., pp. 298-304.

The axes of the fossa of the lacrimal sac and the lacrymonasal duct vary considerably in direction. The more acute this angle the greater is the predisposition to the retention of tears. Dacryocystitis develops in the great majority of cases from stenosis at the level of the junction of the sac and the duct. The white race is more subject to stenosis than the negro. Arisi concludes that the angle formed by the two axes is almost always more acute on the right side, is more obtuse in brachycephalic heads, and more acute in dolicocephalic heads. (5 figures.)

Eugene M. Blake.

Brognoli, Carlo. Considerations in the surgical treatment of ptosis. *Arch. di Ottal.*, 1946, v. 50, July-Aug., pp. 169-192.

The surgical treatment of ptosis was divided by Terrien into four groups: 1. a shortening of the lid by excision of a strip of skin from the lid, 2. the use of the frontalis muscle as an elevator of the lid, 3. advancement, or advancement plus shortening of the levator palpebrae, 4. the use of the superior rectus as an elevator. Brognoli describes representative procedures in each group and evaluates each. Variations of the methods in the third and fourth group were used almost exclusively in

the series reported. Brognoli feels that utilizing a part of the superior rectus as the elevator of the lid has one defect in that the binocular vertical balance is disturbed. This is true when a transplantation is done by the methods of Motais and Bardelli, or a symblepharon is created between the lid and the eyeball by the method of Nida. Shortening and advancement of the levator muscle, whether paretic or paralyzed, seemed to yield the most satisfactory results, using the method of Blaskovic. The method is described in detail. The use of different colored sutures for different tissues is advocated to eliminate confusion. (18 photographs.) Francis P. Guida.

Czokrász, Ida. Contributions to total blepharoplasty. *Brit. Jour. Ophth.*, 1947, v. 31, Feb., pp. 108-113.

Three cases are presented, which illustrate different methods of substituting the total lack of eyelids. Hughes's method is equally adaptable to restore the upper or lower lid. Blaskovic's second operation is suitable when the whole upper lid is missing. The Hungarian plastic generally is used only for substituting the lower lid, but when both lids are lacking the sliding flap is recommended. With loss of both upper and lower lids replacement at once with one arched plasty is indicated, if one is to hope to save the globe. (11 figures.) O. H. Ellis.

Filatov, V. P. Plastic reconstruction of the lids with a round pedicle. *Vestnik Oft.*, 1945, v. 24, pt. 3, pp. 9-10.

Filatov advocates using flaps with round pedicles from the forehead, or the lid of the other eye for plastic reconstruction of the lids. To illustrate their use, he reports three cases, in one of which the left eyeball was left with-

out the protection of the upper lid. The right eyeball was atrophic and the orbit deformed. By means of a round pedicle Filatov used the tissue of the right upper lid for the reconstruction of the left upper lid. Ray K. Daily.

Friberg, Torsten. Physiologic considerations in the treatment of the lacrimal passages. *Acta Ophth.*, 1941, v. 19, pt. 2, pp. 93-108.

The conventional methods of examination and differential diagnosis for the site of the obstruction in the lacrimal passages are reviewed. The author defends Bowman's operation for stenosis of the lacrimal punctum. He regrets that the West-Polyak intranasal operation has not obtained its deserved popularity probably because ophthalmologists find it difficult to acquire a good intranasal surgical technic. Patients with epiphora consult the ophthalmologist first, and are subjected to some other surgical procedure. (Illustration.) Ray K. Daily.

Gandolfi, C. Primary epithelioma of the lacrymal sac. *Rassegna Ital. d'Ottal.*, 1941, v. 10, Nov.-Dec., pp. 576-585.

The bibliography of tumors of the lacrimal sac is reviewed and an instance of primary epithelioma is reported. The tumor was of the papillary type. There follows a discussion of the clinical differential diagnosis of neoplasms of the lacrymal sac. (2 figures.) Eugene M. Blake.

Garbino, Carlos. Allergic reactions to tears from tuberculous patients. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Nov., p. 617.

By means of intradermal tests the author studied the reaction to tears. In the first group he injected tears from allergic children into allergic and non-

allergic ones. A positive reaction was obtained in all allergic children. In the second group the injection of tears from nonallergic children into allergic ones caused no reaction. Children with phlyctenular keratoconjunctivitis as well as healthy ones were used in these experiments. The author concludes that these tests are specific reactions similar to those of tuberculin. (Tables, bibliography.) Plinio Montalván.

Haas, M. E. Ablation of the orbital lacrimal gland. *Ann. d'Ocul.*, 1946, v. 179, Sept., pp. 497-502.

Following an anatomical review, the surgical indications are mentioned. These include prolonged and resistant epiphora due to numerous causes. Chloride of calcium is given several days before the operation to prevent bleeding and hemocoagulin is injected one-half hour before operation. Regional anesthesia with 2 c.c. of 4-percent procaine solution is used. A skin incision is made at the upper temporal orbital margin. The incision is then deepened to include the periosteum which is raised with an elevator. The gland which is fixed by a suture, is dissected with scissors. Deep and superficial sutures of 3-0 catgut are used to close the wound. Chas. A. Bahn.

Ivanova, E. M. Rhinostomy; and its indications. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 12-14.

Averbach was a strong champion of dacryocystorhinostomy, and under his direction 6000 operations had been performed at the Institute. On the basis of this clinical experience Ivanova concludes that the operation is indicated in all cases of purulent dacryocystitis, and that it has no contraindications.

Ray K. Daily.

Kanbai, G. G. Restoration of the lacrimal canaliculus in plastic surgery of the lower lid. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 83-85.

Three cases are reported in which fire-arm injuries of the face involved the lower lid and the lacrimal canaliculus. Plastic restoration of the lower lid was combined with suture of the torn ends of the canaliculus over a probe, which remained in place several days. The results were satisfactory.

Ray K. Daily.

Khaiutin, S. M. Surgical restoration of the lids. *Vestnik Oft.*, 1945, v. 24, pt. 4, pp. 26-28.

Khaiutin utilized the cicatricial tissue of the lid for the inner layer of the new lid, by separating it from the tissues and turning it towards the palpebral fissure. The outer layer of the lid is formed by a pedicle graft from the temple. The author found this technic satisfactory, the results permanent, and the post-operative period comparatively short. (3 illustrations.)

Ray K. Daily.

Lagos, E. J. J. Dacryocystorhinostomy. Technique of Dupuy-Dutemps-Bourguet-Valle. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Nov., p. 639.

The author discusses the advantages of dacryocystorhinostomy over dacryocystectomy in the treatment of dacryocystitis. He prefers the Dupuy-Dutemps-Bourguet-Valle technique and describes the preoperative management of the patient, with special attention to the condition of the lacrimal passages and the nose. The indications and contraindications for dacryocystorhinostomy are discussed. His experience in over 100 operations is briefly reviewed.

Plinio Montalván.

Lloyd, I. A survey of the results of lacrimal stricturotomy. *Brit. Jour. Ophth.*, 1947, v. 31, Jan., pp. 51-54.

The author performed 33 stricturotomies on 31 patients according to the method used in the French clinics. The lower canaliculus is opened with a Weber knife for 3 mm. and dilated with a number 3 sound. The stricturotomy knife is passed down into the sac and engaged in the neck of the duct. It is then verticalized and rotated through an angle of 45 degrees. Gum-elastic sounds from number 11 to 14 are passed and the largest left in situ for 10 minutes. Dilatation is continued at intervals of two weeks for two months.

The French claim 100 percent of patients are cured when there is no bony obstruction and 70 percent when there is. In the hands of the author 52 percent were cured and 24 percent much improved. He feels that the technique possesses many advantages over ordinary probing and that its benefits are considerably more substantial.

Morris Kaplan.

Malbrán, J., and Arrechea, A. Filamentous keratitis and keratoconjunctivitis sicca. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Nov., p. 603.

The authors report four cases of keratoconjunctivitis sicca. They tabulate the symptomatology, review the literature in detail and conclude that filamentous keratitis is due to lacrimal hyposecretion or keratoconjunctivitis sicca, which may result from different causes. The diagnostic value of the Schirmer test is emphasized. (Bibliography.)

Plinio Montalván.

Morano, Massimo. Connections between dacryocystitis and paranasal sinus affections. *Riv. Oto-Neuro-Oft.*, 1943, v. 20, Jan.-Feb., pp. 40-63.

Between January, 1939, and May, 1942, the Bologna ophthalmologic department treated 380 patients with inflammation of the lacrimal sac. Fifty-four had peridacryocystitis complicated by inflammation of the anterior ethmoidal cells, seven complicated by polysinusitis, and only five were without sinus disease. Among those who had only an infection of the lacrimal sac itself, were 66 with anterior ethmoid involvement, one with polysinusitis, and 247 without any paranasal sinus disease. The latter occurs in 92, of 4 percent of all peridacryocystitic processes, and in only 21, or 3 percent of dacryocystitis without involvement of the surrounding tissues. The importance of exact nasal and X-ray examination is stressed. (13 excellent X-ray pictures, 24 references.)

- K. W. Ascher.

Noe, C. A. Penicillin treatment of eyelid infections. *Amer. Jour. Ophth.*, 1947, v. 30, April, pp. 477-479. (8 references.)

Shartz, S. E. The correction of eversion of the lower lacrimal punctum. *Vestnik Oft.*, 1945, v. 25, pt. 3, pp. 36-37.

The author excises a triangle of conjunctiva and subconjunctival tissue below the punctum. The triangular wound is sutured, and the ends of the suture passed through the entire thickness of the lid and tied above the lower orbital margin. An over or undercorrection can be adjusted by tightening or relaxing the suture. (Illustration.)

Ray K. Daily.

Suarez Villafranca, M. R. Malformation of the lacrimal passages; an embryologic study. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Oct., pp. 1027-1037.

The embryology of the lacrimal passages is reviewed, and a case of congenital malformation reported. The 18-months-old child had a congenital coloboma of the left lower lid. There was a mass the size of a pea on the tarsal conjunctiva at birth which gradually increased to the size of a walnut. At the age of three months an attempt at surgical repair of the coloboma failed. There was a fistulous tract in the nasolabial angle, from which a mucopurulent secretion exuded. Pressure on the mass expelled a clear and then a mucopurulent fluid through the misplaced inferior canaliculus. Three surgical procedures were performed: excision of the mass, excision of the fistulous tract, and a plastic operation for repair of the coloboma. Histologically the fistula was found to be lined with cylindric epithelium over a layer of flat cells and the stroma was infiltrated with lymphocytes. The anomaly was probably produced by a failure of the nasal and maxillary bones to coalesce; the disturbance in this region lead to coloboma of the lid, facial asymmetry and incomplete development of the left side of the nose. In the sixth week of embryonic life an epithelial bud forms from which the lacrimal passages develop. If in its development the ectoderm fails to disappear, its invagination into the mesenchyme is disturbed, and it is not included in the osseous lacrimonasal canal. A second possibility is an interference with the closure of the orbitonasal sulcus and a failure to include the lacrimonasal passages. Ray K. Daily.

Tikhomirov, P. E. The relation between epiphora and nasal pathology. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 28-34.

The literature is reviewed and the relevant clinical data in 100 persons with epiphora, and 50 persons from the rhinologic clinic with various nasal diseases are reported in detail. The correlation of the data leads to the conclusion that stenosis of the lacrimonasal canal which leads to dacryocystitis is usually associated with a diseased mucous membrane of the nose. Epiphora due to changes in the upper portion of the lacrimal-apparatus has no relation to nasal abnormalities. In reflex epiphora due to hypersecretion of the lacrimal gland nasal lesions are not infrequent, but their etiologic role is difficult to evaluate, because treatment of the nose does not always lead to cessation of the epiphora.

Ray K. Daily.

Villanueva, M., and Damel, C. S. Mikulicz disease. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Nov., p. 599.

The authors report a case of Mikulicz disease in a 33-year-old man. There was no marked improvement after deep X-ray therapy. (Photographs.) Plinio Montalván.

15

TUMORS

Goedbloed, J., and Wÿers, H. J. G. Lymphoblastoma folliculare. *Acta Ophth.*, 1941, v. 19, pt. 1, pp. 28-43.

The 60-year-old patient, who had enlarged inguinal glands for 13 years, developed small symmetrical orbital tumors. Excision was followed by extensive recurrence with retobulbar extension and exophthalmos. The exophthalmos disappeared after X-ray therapy. Microscopically, the excised tumor presented a typical picture of lymphoblastoma. (7 photomicrographs.)

Ray K. Daily.

16

INJURIES

Brodsky, B. S. The scleral incision in extraction of foreign bodies from the eye. *Vestnik Oft.*, 1946, v. 25, pt. 3, pp. 12-14.

Brodsky opens the eyeball by means of a trephine opening through the sclera. In 10 of 12 patients no incision in the choroid and retina was necessary.

Ray K. Daily.

Carrearas Duran, B. An unknown intraocular foreign-body. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Sept., pp. 926-933.

A man, 24 years of age, had an intraocular foreign body for many years of which he was not aware. For the last two years he had gradually lost vision in his right eye, but before this time his eyes had never given him any trouble. Upon examination an enlargement of the volume of the right eye, a fine corneal scar and optic disk atrophy with deep glaucomatous cupping were found. Tension was 50 mm. of Hg. The left eye was normal. A diagnosis of absolute secondary glaucoma due to intraocular foreign body was made. The eye was enucleated and a small piece of steel was found embedded in the internal retinal layer.

J. Wesley McKinney.

Chechik-Kunina, E. A. Lysozyme in the treatment of burns and perforating ocular injuries. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 42-44.

From the study of 54 patients, the author concludes that in perforating ocular injuries the lysozyme titre is diminished, and that the number of infections is in direct relation to the diminution of lysozyme in the tears.

The titre of lysozyme can therefore be used as a prognostic indication. Clinical instillation of lysozyme into the conjunctival sac every two hours acts favorably in perforating ocular injuries, and in burns in which conservative therapy is effective. Laboratory experiments on rabbits confirmed the effectiveness of lysozyme in burns.

Ray K. Daily.

Ershkovish, I. G. Tissue therapy with Filatov's method in traumatic iridocyclitis. *Vestnik Oft.*, 1946, v. 25, pt. 1, pp. 13-20.

Fifty-eight patients with severe traumatic iridocyclitis after perforating injuries were studied; 36 patients had only one eye, and 28 eyes contained foreign bodies. In 35 there were additional injuries in other parts of the face. In 29 patients tissue therapy was the only therapeutic procedure; in the others tissue therapy was given preliminary to surgical procedures, which could not be performed because of severe inflammatory symptoms or were not indicated because of imperfect light projection. Tissue therapy arrested the inflammatory process, and frequently made surgery possible on an apparently hopeless eye. The tabulated data show that only three of the 58 patients remained without improvement. (1 table.)

Ray K. Daily.

Ershkovich, I. G. The treatment of so-called hopeless ocular war injuries. *Vestnik Oft.*, 1945, v. 24, pt. 4, pp. 19-22.

Because of the results achieved with tissue implantation therapy Ershkovich believes that our prognostic standards need revision. Cases are reported to illustrate that eyes with lesions in the anterior segment and faulty light projection can be given some vision by

means of tissue therapy and surgery. The hopeless prognosis of severe injuries of the optic nerve and retina should also be modified; eyes with dense vitreous opacities, with traumatic chorioretinitic foci involving the macula have been benefited by therapy. Illustrative cases are reported.

Ray K. Daily.

Filatov, V. P. Optic operations on subatrophic eyes. *Vestnik Oft.*, 1945, v. 24, pt. 3, pp. 8-9.

Filatov urges that an effort be made to restore to every soldier some degree of vision. For this purpose he advocates prolonged tissue therapy preliminary to surgery. After tissue therapy faulty light projection may become normal. After that, dissection of organized exudates may lead to restoration of some degree of vision. Two case histories are reported as illustrations. One patient recovered vision of 3/100, and the other 2/100. Even such low visual acuity is appreciated by patients, and no effort should be spared to attain it. Even eyes in the process of atrophy, with faulty light projection should be treated in the hope of recovering light projection, and be given the benefit of optic operations. In seven out of 25 eyes some vision was thus restored.

Ray K. Daily.

Kantorovich, A. I. The indication for extraction of intraocular foreign bodies in old war injuries. *Vestnik Oft.*, 1945, v. 25, pt. 3, pp. 14-17.

A clinical experience with 35 cases shows that late removal of intraocular foreign bodies is much more complicated than early operation. It is even more difficult to establish the magnetic character of foreign bodies after a time. The author believes that a foreign body of long standing in an only eye which

has some vision and is free from inflammatory symptoms is best left alone. An attempt at extraction should be made only when there is an intractable iridocyclitis. If the magnetic test is positive in a patient who has one sound eye the foreign body should be extracted, even if the eye is quiet. With a negative magnetic test accurate localization with X ray is indispensable. A foreign body imbedded in the ocular wall should be extracted through a window opening in the sclera.

Ray K. Daily.

Kolarsz, E. K. Electromagnetic surgery in base hospitals. *Vestnik Oft.*, 1946, v. 25, pt. 3, pp. 9-12.

The large number of ocular injuries in the last war is due to the predominance of artillery fire. Ninety percent of the ocular injuries were caused by fragments, 9.8 percent by bullets, and 69.6 percent of the ocular injuries had intraocular foreign bodies. Only 1.2 percent of these patients reached the base hospitals within ten days after the injury; most of them arrived there one month after the injury and later. Of 245 foreign bodies, 139 were successfully extracted. In 11.8 percent of the patients the eyeball was subsequently enucleated because of a severe post-operative iridocyclitis. In 2.4 percent retinal detachment appeared three to four weeks after the extraction. The author urges extraction within two to three days after the injury, electrocoagulation of the edges of the scleral incision, and the application of the electromagnetic test when foreign bodies are suspected. (3 tables.)

Ray K. Daily.

Levkoeva, E. F. Ocular injuries. *Vestnik Oft.*, 1945, v. 24, pt. 3, pp. 11-19.

On the basis of the histologic examination of 6,000 eyeballs enucleated after

various trauma, Levkoevā sought to evaluate their clinical management. One is impressed with the fact that ocular wounds can not be managed on general surgical principles. The eyeball represents a closed complicated system, with unstable interrelationships of its inner portion; insignificant disturbances, small exudates or hemorrhages may lead to loss of the eye. This is particularly the case in peripheral injuries to the cornea and sclera which maintain the shape of the eyeball. In more or less extensive injuries of this capsule with gaping of the wound, the mechanical abnormality may lead to a disturbance of the intraocular metabolism with all its dire consequences. The first and immediate concern of the surgeon should be accurate closing of such wounds and restoration of normal anatomic relationships, leaving the danger of infection or sympathetic ophthalmia for later consideration. The histologic sections indicate definitely that not closing the wound with sutures is equal to trusting to luck. A Kuhnt conjunctival flap is inadequate to close the wound, and its main objective is the prevention of infection, and not adequate wound closure. Levkoeva vigorously condemns the use of the Kundt flap because it gives false security and she urges the development of a standardized technic for firm and accurate closure of corneal and scleral wounds. (5 photomicrographs.)

Ray K. Daily.

Loginov, G. G. Comparative evaluation of Kundt's conjunctival flap and sutures in the management of ocular wounds. *Vestnik Oft.*, 1945, v. 24, pt. 3, 21-27.

Thirty-seven injured eyes were studied; 19 had corneal wounds, nine scleral, and nine had post-operative

wounds of the anterior portion. When streptocide powder is used the results are better with sutures, than with the conjunctival flap. The defects of the Kuhnt flap are the imperfect coaptation of the edges of the wound, and the prolific growth of connective tissue within the wound. The merit of the Kuhnt flap is the ability to prevent prolapse of uveal tissue and to prevent infection, but these objectives are achieved just as well with sutures. The sutured wound has well coapted edges, withstands raised intraocular tension, and prevents secondary invasion of the wound by microorganisms. There is less connective tissue formed within the sutured wound and within the eyeball. Sutures of the sclera also limit penetration of connective tissue growth. Suturing of the wound shortens the post-operative period. In most severe injuries the sutured eyeball retains its shape. The variety of wounds and their location does not permit the use of visual acuity as a criterion for the effectiveness of the wound closure.

Ray K. Daily.

Mann, Ida, Pirie, A., and Pullinger, B. D. The treatment of Lewisite and other arsenical vesicant lesions of the eyes of rabbits with British anti-Lewisite (BAL). *Amer. Jour. Ophth.*, 1947, v. 30, April, pp. 421-435. (12 figures, 7 tables, 9 references.)

Moncreiff, W. F. Some common errors of the general physician in dealing with foreign body injuries of the eye. *Clin. Med.*, 1946, v. 53, Sept., pp. 257-258.

The commonest mistake is the failure to find foreign bodies embedded in the cornea or hidden in the retrotarsal fold. The use of fluorescein aids in locating the foreign body. Removal with

a cotton applicator should be tried first; if not successful, a sharp, U-shaped spud is recommended.

Irwin E. Gaynon.

Ravasini, C. A case of rupture of the sclera with luxation of the lens beneath Tenon's capsule. *Rassegna Ital. d'Ottal.*, 1941, v. 10, Sept.-Oct., pp. 451-486.

The author describes a case of equatorial rupture of the sclera with luxation of the lens in the posterior segment of the globe, beneath Tenon's capsule. He gives a detailed macroscopic and microscopic description and discusses the pathogenesis and the characteristics of scleral rupture. The scarce literature on this subject is reviewed and abstracted, and demonstrates that for the lens to be dislocated posteriorly the tear in the sclera must be equatorial.

E. M. Blake.

Rodigina, A. M. Surgery of perforating ocular injuries. *Vestnik Oft.*, 1945, v. 24, pts. 1-2, pp. 53-55.

On the basis of clinical experience and experimental work on rabbits, Rodigina advocates suture of corneal and scleral wounds. When there is no injury to the lens, such wounds heal without infection even if sutured several days after the injury. Eyes with injury to the lens healed better when sutured, but dense cicatricial tissue that develops around the lens often leads subsequently to shrinking of the eyeball.

Ray K. Daily.

Sená, José A. Errors in the roentgenologic diagnosis of intraocular foreign bodies. *Arch. de Oft. de Buenos Aires*, 1943, v. 18, Nov., p. 622.

After discussing the value of the roentgenologic investigation of intraocular foreign bodies, the author reports three cases to prove that this

procedure is not always absolutely accurate. In one patient a defect in the X-ray apparatus led to a diagnosis of intraocular foreign body, the existence of which could be disproved by the history and clinical examination. In another the foreign body was clinically located and removed in spite of negative plates. In the third the X-ray film definitely led to a diagnosis of foreign body outside the globe, but the clinical examination and surgical removal proved it to be intraocular. The author emphasizes the importance of a careful clinical examination, to which all other diagnostic procedures must be subordinated.

Plinio Montalván.

Shershevskaya, O. Treatment of war invalids for sequelae of injuries of the eyeball and its adnexa. *Vestnik Oft.*, 1945, v. 24, pt. 4, pp. 15-19.

This material consists of invalids, from one to three years after the injury. The striking feature was the fact that the pathologic process in the eye was not yet completed; in some apparently hopeless eyes massive exudates in the vitreous became absorbed, whereas some eyes which were quiet for a long time suffered severe damage from exacerbations of an old iridocyclitis. Such exacerbations may occur in eyes several years after a perforation in any portion of the eyeball, even without an intraocular foreign body. These processes testify to the great virility and pathogenicity of latent infectious processes within the eye. The lesions were varied, and usually severe and complicated; most eyes had had some surgical repair in the base hospitals. Persistent efforts were made to restore some degree of vision. As an example the case of a 21-year-old man is reported. His only eye had an almost complete leucoma, with a small area of

clear cornea close to the limbus, through which one could see the atrophic iris adherent to the cornea. The first operation was a keratoplasty with resection of the adherent iris; the cataractous lens, which then became visible was removed at a second operation six weeks later. Corrected vision was 0.06. Later glaucoma developed, which was controlled by paracentesis. The clinical experience with this group of patients demonstrates that old exudates in the vitreous may be absorbed under intensive therapy, and considerable vision obtained. An original procedure described is an excision of the sphincter of the iris with the cicatricial membranes attached to it. After a corneal incision a small knife punctures the sphincter, and with a sawing motion the entire sphincter is cut away from the iris; the sphincter with the lens capsule and organized exudate is removed with forceps. Preliminary X-ray irradiation is probably important in the smooth postoperative recovery.

Pedicle grafts were used for plastic repair of the lids. Ray K. Daily.

Stellard, H. B. The intraocular foreign body. *Brit. Jour. Ophth.*, 1947, v. 31, Jan., pp. 12-40.

This long, detailed article is the report of 72 cases of penetrating wounds of the eye with retained foreign body and is a sequel to a report of 102 such cases previously reported. They occurred in the campaigns in the Western Desert and in Normandy. The majority of foreign bodies produced by fragmentation of modern air missiles are so slightly magnetic that the technique of localization and extraction differs from that in civil practice. The "magnet test," pain caused by waving the magnet over the eye, was negative in many cases, and yet if the giant magnet tip

was placed very close to the foreign body its extraction was effected.

Investigation must be complete. Many wounds of entry are well healed at the time of examination, and all the surrounding adnexa must be carefully studied. In one case a shell splinter entered the occiput, traversed the intracranial contents, entered the orbit from behind, penetrated the sclera and came to rest in the vitreous while the patient remained completely unaware of it.

Aluminium and some nonmetals give rise to no signs of irritation within the eye and if not large enough to obstruct vision are best left alone. Small pieces of glass and bakelite were left alone but copper and stone caused violent inflammation. Localization was accomplished by ophthalmoscopy in 45 patients. X-ray was used on all the others. The Sweet and Dixon methods are the most ideal but were entirely unsuited for mobile warfare. A limbal ring sutured to the conjunctiva was used and served well enough.

For extraction, the posterior scleral route was much preferred with the use of the Solus giant electromagnet. The instrument was always mounted on a stand. The area around the incision was always subjected to diathermy and no retinal separation or even vitreous loss was experienced. Stallard insists that retinal detachment does not follow careful surgery. There were no infections.

Visual results were very satisfactory. Morris Kaplan.

17

SYSTEMIC DISEASES AND PARASITES

Feigenbaum, A., and Kornblueth, W. Posterior ring abscess of metastatic origin in Behcet's disease. *Brit. Jour.*

Ophth., 1946, v. 30, Dec., pp. 729-734. (See section 6, Cornea and sclera.)

Gilbert, T. M., and Hing, S. R. The Stevens-Johnson syndrome. M. J. Australia, 1946, v. 2, Nov. 30, pp. 774-776.

The occurrence of Stevens-Johnson syndrome in a 40-year-old soldier is described. The patient had typical lesions of the oral mucous membranes, followed by a sloughing pseudomembrane. There was bilateral purulent conjunctivitis, in the course of which conjunctival bullas eventually developed. The patient had a moderate hyperpyrexia, and an exanthematous dermatitis that resembled erythema multiforme.

On the fifth day, pneumonia developed. The patient was treated with penicillin systemically and locally in the eyes. Within two weeks the conjunctivitis and stomatitis had cleared up, and the patient was discharged as completely cured after five weeks. The conjunctival blebs and the pulmonary complications were considered to be unusual features. Benjamin Milder.

Gordon, D. M. Hemifacial spasm. Arch. of Ophth., 1947, v. 37, March, pp. 282-293.

Hemifacial spasm is a condition in which the patient has paroxysms of twitchings in muscles innervated by the seventh nerve. The condition is not under voluntary control and defies mimicry. Hemifacial spasm is not a tic. The spasm occurs during sleep and is not broken by will. It is usually clonic but may become tonic.

The condition of hemifacial spasm is described and attention called to the fact that at least two forms exist, one idiopathic and the other following regeneration of a traumatized seventh

nerve. An illustrative case of each is presented. Treatment, differential diagnosis, and literature, are discussed.

R. W. Danielson.

Jebejin, R., and Kalfayan, B. Oculobuccogenital syndrome. Ann. d'Ocul., 1946, v. 179, Sept., pp. 481-491.

In a preceding article the authors described this syndrome which consists of acute iritis with hypopyon, ulcers of the mouth and genitals, and nodular erythema. Frequent also is recurrent swelling of the salivary glands with fever and recurrent retinal hemorrhage with proliferative changes, especially in the young. An acid resisting bacillus was found in the sections but its cultural characteristics have not been determined. The authors believe that the initial stage is characterized by phlebitis with recurrences, which may be complicated by more or less obliterative thrombosis, but which usually heal. The symptoms are probably a part of a general infection transmitted through the blood in which phlebitis is an important factor, but in which allergy also plays a part. Behcet, whose name is associated with part of this syndrome suggested that a virus infection is the probable cause. The authors concluded that this syndrome is not an atypical form of tuberculosis. (6 references.) Chas. A. Bahn.

Koff, R., and Rome, S. Diabetic retinopathy. Western Med. and Surg., 1947, v. 1, March, pp. 31-34.

A large percentage of diabetic patients develop retinal damage and many of them will suffer enough loss of vision to become occupationally disabled. One or two percent will become totally blind. Visual deterioration may take months or years to develop, but

may be retarded or arrested by the coordinated care of the ophthalmologist and internist. (5 fundus photographs.)

O. H. Ellis.

Krutova, A. H. Primary and secondary eye lesions in tularemia. *Vestnik Oft.*, 1946, v. 25, pt. 4, 23-26.

A drop of a culture of the organism instilled into the conjunctival sac of one eye of a rabbit produced characteristic granulomatous lesions in every case. The control eye remained normal, except in one animal which had extensive hemorrhages into the lacrimal gland. Nearly all animals died from a generalized infection before the pathologic process in the eye was concluded. The microscopic studies revealed granulomatous foci in the cornea and ciliary muscles. Secondary ocular lesions appear on the eighth or ninth day of the infection, are bilateral, and are not associated with a local lymphadenitis; the clinical symptoms indicate that they are the result of a hematogenous metastatic process, the original focus of which may be in an internal organ. This study emphasizes the importance of a thorough general examination of patients who have apparently recovered from Parinaud's disease.

Ray K. Daily.

Laforet, E. G., and Lynch, C. L. Multiple congenital defects following maternal varicella. *New England J. Med.*, 1947, v. 236, April 10, pp. 534-537.

A well authenticated episode of maternal varicella complicated the eighth week of pregnancy. An infant was born with extensive developmental defects. The theoretic implications are discussed.

F. H. Haessler.

Lijó Paviá, J. Sella turcica. Bone lesions. Retinal changes. Favorable

treatment with gonadotropine. *Rev. Oto-Neuro-Oft.*, 1946, v. 21, July-Aug., pp. 73-81.

This paper presents eight further cases of sellar lesions, which, like three similar ones that have been reported were successfully treated with hormones. In this new series the patients were 16 to 47 years of age, five of them were female. They complained of diminishing visual acuity. The ophthalmoscopic findings included choroidal vascular sclerosis, retinal vascular sclerosis, foveal pigment changes, retinal hemorrhage, macular changes, chorioretinal atrophy, and pale discs. All showed radiographic evidence of sellar changes, such as osteolysis, and rarefaction or decalcification of the clinoid processes. Three of the patients had syphilis, and six showed evidence of endocrinal disturbance. All had mild to severe concentric contraction of the field. After treatment with lobulantine, the majority showed definite improvement in visual acuity. (Bibliography, 8 schematic radiographs.)

Edward Saskin.

Puglisi-Durante, G. The behavior of the cerebrospinal fluid in ocular and nervous affections from acquired lues. *Riv. Oto-Neuro-Oft.*, 1946, v. 21, May-Aug., pp. 153-167.

Tests were made on the cerebrospinal fluid of patients with different eye diseases of luetic origin (tabetic optic atrophy, postneuritic optic atrophy, optic neuritis, choked disc, oculomotor paralysis). The findings were compared with those obtained in cases of cerebrospinal lues with no eye complications. The result of the investigation in tabulated form demonstrates that the changes of the cerebrospinal fluid only show that a luetic condition

exists in the neuro-axis and its meninges. (Bibliography.)

Melchior Lombardo.

Sironi, Luciano. Ocular symptoms in a case of neuraxitis. *Riv. Oto-Neuro-Oft.*, 1942, v. 19, Sept.-Oct., pp. 327-337.

A 20-year-old man presented paresthesias and pareses of his limbs and signs of paralysis of his seventh, ninth, and twelfth cranial nerves; there was a paresis of his right sixth nerve, and nystagmus in extreme lateral gaze. Meticulous study lead to the diagnosis of a disseminated encephalomyelitis (neuraxitis).

K. W. Ascher.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Fallippi-Gabardi, E. Falloppio's description of lacrimal fistula. *Rassegna Ital. d'Ottal.*, 1946, v. 15, July-Aug., pp. 315-318.

Gabriele Falloppio, the great anatomist and surgeon of the renaissance, was the first to give a clear description of the lacrimal passage and its affections. The article is an historical review of the early knowledge of the lacrimal apparatus.

Eugene M. Blake.

James, R. R. Mr. Surphlete, an item of ophthalmological history. *Brit. Jour. Ophth.*, 1947, v. 31, Jan., pp. 3-8.

The will of one Richard Surphlete, who lived in the early seventeenth century is reprinted and commented upon. There is some question as to who Surphlete, a quack oculist, was. The testator may have been the translator of Laurentius. The will is of interest in many ways, and particularly as showing what a medical man took to sea with him.

Morris Kaplan.

Traquair, H. M. Removal of the wrong eye. *Brit. Jour. Ophth.*, 1947, v. 31, Jan., pp. 8-12.

Traquair discusses the truth of the oft repeated statement that the wrong eye had been surgically removed. All the evidence is marshalled, but he has been able to find none that is conclusive.

Morris Kaplan.

Vasserman, I. A. Glaucoma in Turkmen. *Vestnik Oft.*, 1946, v. 25, pt. 5, pp. 47-50.

A brief summary of the tabulated data of the various institutions that treat ocular diseases shows that glaucoma heads the list of causes of blindness, and that its incidence in Turkmen does not differ from that of middle Europe.

Ray K. Daily.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Forbes, G. Microphthalmos. *Brit. Jour. Ophth.*, 1946, v. 30, Dec., pp. 709-715.

The eyes of a six-months-old fetus were microphthalmic and one was removed for serial section. It was 8 mm. in diameter. The sclera presented a fibrous band which divided the ball into a small, anterior, inferior cyst and the larger true eye. This cyst communicated with the vitreous chamber and was lined with choroid and retinal pigment layer. The cyst cavity was filled with disorganized retina that was lying free. The conjunctiva was normal and the cornea was very cellular with no discernible Bowman's membrane. The choroid presented scant pigment, was folded in many places but seemed to line the entire sclera. Ciliary processes were undeveloped and iris muscles could not be seen. The ciliary muscle

was present. The lens was large and spherical and showed several irregular projections; its center was a degenerated cataract. The retina was detached and thrown forward, and had no demonstrable rods and cones.

Normally the fetal fissure begins to close in the 11 mm. stage. In this case some interference occurred earlier, probably between the fourth and sixth weeks since much tissue differentiation was obvious. There was no family history of irregularities and there was no illness of any kind during pregnancy. It was decided, nevertheless, that this malformation originated from a genetic defect or because the mother suffered an unnoticed subclinical infection.

Morris Kaplan.

Gallego, Antonio. Notes on the vasomotor fibers of the retina. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Dec., pp. 1245-1246.

Gallego illustrates with photomicrographs the vasomotor retinal fibers of a dog. The central retinal artery is surrounded by an extensive nerve fiber network which can be followed for large extents. In one case the terminal bulb is seen. Some capillaries are surrounded by a fine network of nerves, without terminal bulbs. (3 photomicrographs.)

Ray K. Daily.

Gurchot, C., Krebs, E. T., Jr., and Krebs, E. T. Growth of human trophoblast in the eye of the rabbit; its relationship to the origin of cancer. *Surg. Gyn. and Obstet.*, 1947, v. 84, March, pp. 301-312.

Explants of tissue obtained from normal human placentas aged 2, 5, 7, and 9 months, were placed in the eyes of eight rabbits through incision made at the corneoscleral margin. A description of the sequence of events in each rabbit and the laboratory work which followed is given. The discussion includes 96 references. The results indicated that the tissue grew easily and promptly in the anterior chamber of the rabbit and in a manner analogous to malignant tumors. The placental tissue is referred to as heterologous trophoblast.

Francis M. Crage.

Landau, E. Contribution to the histology of the eye. *Ophthalmologica*, 1946, v. 112, Sept., pp. 129-134.

The author presents two diagrammatic but not very clear drawings prepared from his sections (type of eye, method of staining not stated) which are intended to show that a certain portion of the fibers of the zonule is attached to the retina. He believes that the internal limiting membrane of the retina is in reality the prolongation of the zonule of Zinn. He then describes and depicts the histologic details of the innervation of the ciliary body, without adding significantly to or deviating from present concepts.

Peter C. Kronfeld.

Suarez, Villafranca, M. R. Malformation of the lacrimal passages; an embryologic study. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Oct., pp. 1027-1037. (See Section 14, Eyelids and lacrimal apparatus.)

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
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News items should reach the editor by the 12th of the month

DEATHS

Dr. Harlan Page Abbott, Providence, Rhode Island, died February 2, 1947, aged 86 years.

Dr. Frederick James Bentley, Seattle, Washington, died January 1, 1947, aged 71 years.

Franklin Fayette Lane, Capt. (MC), U.S.N., Philadelphia, Pennsylvania, died January 29, 1947, aged 58 years.

Dr. Giovanni Paccione, New York, New York, died January 22, 1947, aged 60 years.

Dr. Morris Rosenbaum, New York, New York, died February 1, 1947, aged 66 years.

Dr. Thomas Hall Shastid, Duluth, Minnesota, died February 15, 1947, aged 80 years.

ANNOUNCEMENTS

COURSE IN NUCLEAR PHYSICS

The University of California Medical School, in association with University Extension, University of California, announces a course in the applications of nuclear physics to the biologic and medical sciences to be given at the Medical Center in San Francisco from June 30 through July 18, 1947.

The course will consist of didactic lectures, laboratory demonstrations, and seminars for round-table discussions. It will be open to individuals in the fields of medical and biologic research. For detailed information write to: Dr. Stacy R. Mettler, Head of Postgraduate Instruction, Medical Extension, University of California Medical Center, San Francisco 22.

HEED OPHTHALMIC FOUNDATION

The Heed Ophthalmic Foundation for training eye surgeons after they have finished their residencies, established by Mr. and Mrs. Thomas Heed of Evanston, Illinois, has a fund sufficient to support three fellowships, each amounting to \$2,500 to \$3,000. A board of five ophthalmologists representing medical schools throughout the nation will handle the fellowships. Additional information and application blanks may be obtained from the secretary of the board of directors, Dr. M. Hayward Post, 520 Metropolitan Building, 508 North Grand Boulevard, St. Louis 3, Missouri.

POSTGRADUATE COURSES ANNOUNCED

The University of California Medical School announces a postgraduate course in ophthalmology to be given at the University of California Medical Center, September 15 through 19, 1947. Classes will meet daily from 8:30 A.M. to 12 noon, and from 1:30 to 5 P.M. Requests for

information and for registration are to be addressed to: Dr. Stacy R. Mettler, Head of Postgraduate Instruction, Medical Extension, University of California Medical Center, San Francisco 22.

TECHNICIANS' EXAMINATIONS

American Orthoptic Council examinations will be held in September and October, 1947. Applications on official forms must be received before July 1, 1947. Address the American Orthoptic Council, 23 East 79th Street, New York 21.

SOCIETIES

BROOKLYN'S 100TH MEETING

The 100th regular meeting of the Brooklyn Ophthalmological Society was held on April 17th at the Brooklyn Eye and Ear Hospital. The scientific program included the following papers: "Eales' Disease," Dr. Anthony J. Baranco; "Cholesterin Crystals in the Anterior Chamber," Dr. Louis Freimark; "Toxoplasmosis in Infants," Dr. Carol Schwartz; "Heterochromia Iridis," Dr. Samson Weingeist; "Binocular Single Vision with a Contact Lens after a Unilateral Cataract Extraction," Dr. John H. Bailey; "Uveitis of Undetermined Origin," Dr. James H. Inciardi; "Vessel in the Vitreous," Dr. Louis Freimark; "Calcium Soap Cyst of the Conjunctiva," Dr. Edward Saskin; "A Case of Malignant Exophthalmos," Dr. Max Fratkin; and "Unusual Melanosis of the Iris," Dr. Walter Moehle.

MEETS WITH NEUROPSYCHIATRIC SOCIETY

On April 29th, the Milwaukee Oto-Ophthalmic Society held a joint meeting with the Milwaukee Neuropsychiatric Society. The scientific program consisted of a symposium on vertigo.

PERSONALS

Dr. Parker Heath of Detroit will move to Boston about July 1, 1947, to become pathologist at the Massachusetts Eye and Ear Infirmary. Dr. Heath will also be in charge of postgraduate teaching of ophthalmology at the Harvard Medical School and will have the rank of clinical professor.

Dr. Derrick Vail has moved his offices from the Pittsfield Building to 700 North Michigan Avenue, Chicago 11, Illinois.

CYCLODIALYSIS: A FOLLOW-UP STUDY*

H. SAUL SUGAR, M.D.

Detroit

Since Heine,¹ in 1905, first described a procedure for operative detachment of the ciliary body from its insertion, the operation, which he termed cyclodialysis, has passed through various phases of popularity. Now, after more than 40 years of use in the treatment of glaucoma, reevaluation of the procedure is indicated. As part of such a reevaluation, a follow-up study of 121 cyclodialysis operations is the basis of this paper.

The first operative procedure to employ incision through the insertion of the ciliary body to form a communication between the chambers of the anterior segment and the suprachoroidea was that of Hancock² in 1861. He described six cases in which the operation was used. The procedure was modified by Heiberg³ of Christiania. In 1900, Quereghi⁴ described a procedure similar to those of Hancock and Heiberg. He called it a sclerocyclotomy or sclerochoriotomy. A transverse incision was made through the sclera and uvea behind the insertion of the ciliary body. Quereghi believed that glaucoma depended upon the lack of communication between the suprachoroidal space and the anterior chamber.

Chibret,⁵ in 1897, described a proced-

ure, which he called a sclero-cyclo-iridic puncture, for the treatment of glaucoma. He made an incision through the sclera, 3 to 4 mm. from the limbus, and guided the knife through the anterior portion of the ciliary body into the anterior chamber. When the point of the instrument appeared in the anterior chamber, it was directed backward to spear the iris which was then pulled toward the pupillary center. The procedure was repeated in 5 or 6 meridians. Eserine was used to pull the iris from the angle.

These contributions played no part in Heine's work but are cited only as evidence of the evolution of thought along this line. Heine's work was based on the observations of Fuchs and Axenfeld. Fuchs,⁶ in 1900, had found a choroidal detachment associated with low intraocular pressure after about five percent of his operations for senile cataract in otherwise normal patients. Two years later,⁷ he observed them after iridectomies for glaucoma. Axenfeld⁸ saw choroidal detachment in 10 percent of patients after iridectomy, sclerotomy, and incisions in the chamber angle. He brought up the question as to whether choroidal detachment had anything to do with the action of iridectomy in glaucoma. Demaria in Axenfeld's clinic then demonstrated, in an eye after iridectomy for glaucoma, a tear in the ciliary-body insertion which permitted communication between the suprachoroidea and anterior chamber.

*From the Illinois Eye and Ear Infirmary, University of Illinois College of Medicine, and Michael Reese Hospital, Chicago. Under a grant from the W. K. Kellogg Foundation. Presented before the Chicago Ophthalmological Society February 17, 1947.

This suggested that perhaps an artificial communication of this type would be useful in lowering intraocular pressure in glaucoma.

Heine first reported 26 operations, then a total of 56, in 1906.⁹ In 1913,¹⁰ he reported on 103 eyes on which the operation was performed. The procedure he described included a conjunctival incision, 8 to 9 mm. from the limbus, in either of the four quadrants, between the rectus muscles. The sclera was bared and an incision 2 mm. in length was made in the sclera, 4 to 5 mm. from, and concentric with, the limbus. Through this opening a spatula was inserted between the sclera and choroid into the anterior chamber, and the ciliary-body insertion was severed.

The operation was done on blind or nearly blind eyes and on various types of glaucoma in the first series of operations. Heine's reports were followed by many others. Meller¹¹ reported 48 cyclodialysis operations in 42 cases. Wernicke¹² described 67 cyclodialyses (20 of which had been in Heine's reports). Elschmig,¹³ Boldt,¹⁴ Waldstein,¹⁵ Meissner and Sattler,¹⁶ Windrath,¹⁷ and Knapp¹⁸ added many cases to the early reports. Salus¹⁹ then accumulated all the data on cyclodialysis up to 1920 for his comprehensive report. Since then, anatomic and gonioscopic data have established the *modus operandi* of cyclodialysis.

Heine's original idea was that the operation would produce a new pathway whereby aqueous would enter the suprachoroidal spaces and be slowly absorbed. Krauss,²⁰ in 1907, undertook to determine the mode of action of cyclodialysis by performing the operation on 20 eyes of rabbits and 12 eyes of cats. In all cases, a solid cicatrix formed at the operative site. The choroid and sclera became tightly adherent to the sclera. The angle of the chamber was obliterated in

all. Krauss expressed the opinion that the operation acted by reducing the pathologic accumulation of intraocular fluid by producing a more or less extensive atrophy of the uveal tract.

Other investigators, including Judin,²¹ Wichodzeff,²² Wernicke,¹² and Elsberg,²³ had results similar to those of Krauss. Wernicke pointed out, correctly, I believe, that the mode of action of the operation cannot be determined by animal experiments. This same conclusion was drawn by Elschmig,²⁴ in 1932, after Stoutenborough²⁵ and Loddoni²⁶ reported experiments on animals in which they found no atrophy of the ciliary body after cyclodialysis.

Gradle,²⁷ in 1920, was of the opinion that the reduction in intraocular pressure after cyclodialysis was due to freeing of the angle of the anterior chamber, allowing aqueous to escape through the canal of Schlemm. Beard²⁸ was of the same opinion. Apparently this theory was held by many in the United States for, in 1914, the contributor to the *American Encyclopedia of Ophthalmology*²⁹ stated that "from the few glaucomatous eyes which have as yet been examined after this operation, it is not possible to state whether the procedure can reopen the angle of the anterior chamber."

Salus,¹⁹ in his comprehensive paper, in 1920, concluded that the pressure-relieving effect of cyclodialysis depends on a partial atrophy of the ciliary body which results from obliteration of numerous arteries, and perhaps also from damage done to ciliary nerves.

In the reports on eyes enucleated after unsuccessful cyclodialysis by Heine,¹ Krauss,²⁰ Weekers,³⁰ Meller,¹¹ Wernicke,¹² Meissner and Sattler,¹⁶ Elschmig,¹³ von Grosz,³¹ and Kronfeld,³² no cleft was found. Atrophy of the ciliary body at the site of operation alone, was present in Weeker's, von Grosz's, and

Kronfeld's cases. In the others, atrophy was also present elsewhere in the ciliary body.

Elschnig had been of the opinion that the cyclodialysis operation acted through irritation of the iris and by straightening of angulated veins in the iris root, but in 1932²⁴ he had the opportunity to examine an eye of a patient who had had a successful second cyclodialysis 14 years before. He found a definite communication between the suprachoroidea and the anterior chamber. This was the first proof of Heine's original contention. It has since been amply corroborated by gonioscopic studies.

The first gonioscopic evidence of the mode of action of cyclodialysis was presented by Vannas³³ in 1935. He studied 37 cases of cyclodialysis and found patent clefts in 20 and none in 13. In 30 of the 37 there was normal tension. Four of the eyes with open clefts had been operated upon from 8 to 13 years previously.

In 1936, Barkan, Boyle, and Maisler³⁴ reported the gonioscopic data in 14 cases of primary glaucoma in which cyclodialysis had been done. In each of 11 cases in which the operation had been successful, a patent cleft was found. In three unsuccessful cases, reattachment of the ciliary body had occurred. In one of the latter, a second cyclodialysis was successful and resulted in the formation of a patent supraciliary cleft.

In 1940, I studied a series of 65 cyclodialyses on eyes with primary glaucoma and 56 cyclodialyses on eyes with secondary glaucoma following cataract operations, and found an "all-or-none" relation between success of the operation and the formation of a patent supraciliary cleft. This study was published in 1941³⁵ and 1943.³⁶ After an interval of 5 to 6 years, I have reviewed this same series of cases to determine the

validity of my original conclusions.

Let us consider first the series of 65 operations for primary glaucoma. Of the 65 cyclodialyses, 34 (52.3 percent) were successful in reducing the tension to normal. The tonometric tensions varied from 8 to 21 mm. Hg (Schiotz), averaging 15 mm. in 33 cases. In one case the tension at times reached 32 mm. Hg and so required miotics for control. In this case there was a very small patent cleft involving about 5 to 10 degrees of the circumference of the angle. In each of the 33 other cases, there were patent clefts. In the 31 cases of unsuccessful cyclodialysis, no cleft formation was revealed. In nearly all cases, there was stripping of a portion of Descemet's membrane, and in some there was reattachment of the ciliary body posterior to its original position. Thirteen of these cases were of the congestive type of glaucoma and 52 had simple glaucoma.

Since the early experiences with the cyclodialysis operation, warnings have been made repeatedly against using the operation in congestive glaucoma. Heine¹ realized this, in 1905, when he stated that the more urgent the indications the less beneficial are the results of cyclodialysis. However, the operation has been used with success in some cases of acute glaucoma, particularly where iridectomy has failed. Csillag³⁷ reported 10 successful cases including one of six-years' duration. Bangaerter and Goldmann³⁸ advised the operation in "inflammatory glaucoma" where iridectomy had been unsuccessful.

REVIEW OF CASE REPORTS

In my first report I divided the cases of cyclodialysis for congestive glaucoma into eight cases of cyclodialysis done for acute glaucoma and five for chronic congestive glaucoma. Although I now consider both groups together under acute

(narrow-angle) glaucoma, I shall consider the follow-up study on these cases under the two original subdivisions.

CASES OF ACUTE GLAUCOMA

Of the eight cases of cyclodialysis on eyes with acute glaucoma, the original observations indicated success in three and failure in five. Of the three successful cases, one experienced an acute attack nine months later, requiring further surgery. A second, operated in 1937, was still successful, with an open cleft, in 1946. The third is interesting enough to warrant description in detail.

This 27-year-old man had experienced blurring of vision, pain, and often slight injection of the right eye intermittently about twice weekly since the age of 17 years. These episodes usually occurred after seeing a motion picture or after reading, usually at night. On November 29, 1938, his pupils were dilated for refraction with 2-percent homatropine hydrobromide. The pupil of the right eye never returned to its normal diameter. Two days later he began to have pain and slight injection of the right eye. When seen four days later, the tonometric reading for the right eye was 60 mm. Hg (Schiotz). The conjunctiva was very slightly injected. Miotics were ineffective in reducing the tension to normal. A trephination done on January 11, 1939, on the right eye was unsuccessful. It was followed on February 8, 1939, by a right cyclodialysis. This was successful. The tension remained low and the cleft was visible gonioscopically. However, nearly four years later, on December 8, 1942, the right tension was elevated to 52 mm. Hg (Schiotz). On eserine therapy the tension returned to normal and has remained normal on miotics until the time of writing. The cyclodialysis cleft is open but shallow.

This case indicates the possibility of

recurrence of acute glaucoma even in a previously, successfully operated eye where this particular operation has been used. It also indicates that the cleft may again regain its patency under miotic therapy.

Of the five cases of cyclodialysis done on eyes with chronic congestive glaucoma, two were unsuccessful at the time of my first report. One of the successfully treated eyes remained normal until the present time. The second could not be followed after the year 1941. The third remained normal with an open cleft from 1939 to 1944, when a lens extraction was done. The eye subsequently became hard and even light perception was lost.

As a group, these cases of narrow-angle acute glaucoma may respond successfully to cyclodialysis; however, the cleft may be closed either by a recurrence of the original angle-blocking process or by subsequent surgery.

CASES OF SIMPLE GLAUCOMA

The remaining 52 eyes, upon which cyclodialysis for simple glaucoma was performed, represent the bulk of the follow-up series of primary glaucoma. The observations made for my first report indicated that there was no recurrence of ocular hypertension in the 28 successfully operated eyes following subsidence of all postoperative reaction. The longest interval between operation and observation was five years.

Now, after an additional six years, 11 of the 28 eyes have remained normal with open cyclodialysis clefts, and 13 could not be checked during the entire follow-up period because of death or because the patients did not return to the clinic. All of the eyes in this group of 13 had normal tension (one later required miotics for control) and an open cleft as long as they were followed.

Two other eyes were normal and had an open cleft until a cataract extraction was done, following which the glaucoma recurred. In one of these a second cyclodialysis was successful in returning the tension to normal and resulted in an open cleft. This patient was followed for only one year after the second cyclodialysis operation. Another patient had had an open but shallow cyclodialysis cleft for a year after operation but did not return to the clinic until five years later, at which time the eye was hard and the cleft closed. The one remaining eye of the series of 28 was one which continued to have a low tension, but the cyclodialysis cleft could not be seen.

As was previously pointed out,³⁵ the presence of synechias in the chamber angle before operation had little effect on the success of the operation. Twenty-four of the 65 eyes were observed preoperatively with the gonioscope. Four of these had acute glaucoma, two had chronic congestive glaucoma, and 18 had simple glaucoma. In the four eyes with acute glaucoma the angles were completely obliterated before operation. Two of the four cyclodialysis operations performed on these cases were successful. Of the two eyes with chronic congestive glaucoma, one angle was open and the other obliterated before operation. The one with the obliterated angle was normalized by cyclodialysis. The one with the open angle was not only an operative failure, but the angle was obliterated following operation except at the operative site where there was no cleft but where the angle remained open. Of the 18 eyes with glaucoma simplex which were gonioscoped preoperatively, 12 were open, four partly open, and two obliterated. Seven of the 12 open ones became normal after cyclodialysis. Two of the eyes with partly open angles became normal. Both of the eyes with obliterated angles

were successfully operated. In all of the successful cases, there were open clefts.

CASES OF SECONDARY GLAUCOMA

The series of 56 cyclodialyses in 52 eyes with secondary glaucoma occurring after cataract operation presented similar follow-up findings. At the time of the original study 23 of the 56 operations were successful (41 percent). All of these had a cyclodialysis operation in the years 1939 or 1940. Seven of the 23 eyes continued to have open cyclodialysis clefts when examined in 1946, and 10 could not be checked during the entire follow-up period, because of death or because the patients did not return to the clinic. All of these eyes had normal tension and an open cleft as long as they were followed.

In the remaining six patients, the tension became elevated during the follow-up period. In one of these the tension rose to 60 mm. Hg (Schiotz) in two years after operation. The cleft was obliterated at this time. In a second case, the tension rose to 37 mm. Hg after two years, but has usually been normal since then. However, because of corneal opacity which has developed during the interim, the presence or absence of a cleft cannot be determined. The four remaining eyes have had tonometric readings of up to 37 mm. Hg (Schiotz) but continue to have small, open, but shallow, cyclodialysis clefts.

SUMMARY

In summary, then, the original 52.3 percent of successful outcomes in cyclodialysis in primary glaucoma has been reduced to 46.1 percent after 5 to 6 years. In secondary glaucoma after cataract extraction, the percentage of success after 5 to 6 years has been reduced from 41 percent to 30.3 percent. This reduction in the percentage of successful cases would seem to indicate the need for some

modification of my conception of an "all-or-none" relationship between success of the operation and the formation of a communication between the anterior chamber and the supraciliary space.

The modification of this concept would, however, be necessary only from a gonioscopic point of view, since at times one sees what appears to be an open, shallow cleft but its extent cannot

absence of a functioning cleft can be determined gonioscopically. Then, the "all-or-none" relationship certainly holds true. The fact that ocular hypertension recurs if the cleft closes is our best clue to the *modus operandi* of the cyclodialysis operation. It indicates that atrophy of the ciliary body is not the cause of success.

I have suggested that the markedly

TABLE 1
RESPONSE TO ANTERIOR-CHAMBER PUNCTURE IN EYES WITH CYCLODIALYSIS

Patient	Type of Glaucoma	Tension before Puncture	Tension Immediately after Puncture	Tension after Puncture (mm. Hg Schiøtz)					Volume Aqueous (cc.)
		mm. Hg	(Schiøtz)	½ hr.	1 hr.	1½ hrs.	2 hrs.	2½ hrs.	
1. M.H.	Post-cataract	12.5	0	0	0	12	21	21	0.26
2. J.L.	Post-cataract	21	0	2	8	12.5	22.5	26	0.185
3. C.C.	Post-cataract	23	0	0	14	24.5	24.5	40	0.22
4. V.S.	Post-cataract	12	0	0	0	10	17	24.5	0.14
5. A.J.	Acute glaucoma	15	0	0	6	10	12.5	17	—
6. M.C.	Simple glaucoma	21	0	0	4	6	10	14	0.24
7. C.C.	Simple glaucoma	15	0	0	0	8	21	24.5	0.245
8. A.B.	Simple glaucoma	30	4	18	30	40	46	40	0.19

be determined. If the cleft is shallow and extends only a very short distance back, it is usually functioning only partially. In some cases, diasceral illumination during gonioscopy is helpful in determining the extent of the cleft.

The tonometric readings should be considered in conjunction with the gonioscopic picture in drawing conclusions as to the functioning of a questionable cleft. In most cases, however, the presence or

increased vascular wall-surface area made available through the cleft permits increased osmotic absorption of aqueous. That the cyclodialysis operation is an ideal substitute for the Schlemm's canal mechanism is shown by the response to anterior-chamber puncture in eyes of eight patients, all included in the follow-up series reported herein. Four of the eight cyclodialyses were done for glaucoma due to complete anterior synechias

following operations for cataract. Three others were for simple glaucoma, and the remaining one followed unsuccessful iridectomy for acute glaucoma. The results are shown in Table 1. Only in one patient, in whom the cyclodialysis was only relatively successful, was there a typical reactive hypertension. In another, a delayed rise to 40 mm. Hg (Schiotz) was found. The chamber puncture caused no subsequent change in the intraocular pressure or the cleft in these cases.

In certain cases where the tension has been successfully reduced but no cleft can be seen, failure to determine the cause of success is disconcerting. However, one may find the cause in some instances, not in others. In one instance, I observed subconjunctival filtration at the site of the scleral incision where choroid was incarcerated in the wound. In another the cleft could not be seen because an anterior synechia had formed a bridge between the iris and cornea and was located like a screen in front of the cleft. Only an opening at one side could be seen; so the presence of a patent cleft could only be inferred from the fact that the tension continued low.

One must, of course, be especially careful when observing the tension during the first six weeks after operation. During this period, even with no visible cleft, the tension may be normal. The eyes are usually somewhat injected and soft because of the reactive vasodilatation. When the eyes pale, the tension in such cases usually goes up.

In a study³⁵ to determine the length of time which may elapse after operation before one can judge the success or failure of cyclodialysis, I ascertained the time between operation and the first occurrence of tension above 28 mm. Hg (Schiotz) in 19 eyes with simple glaucoma, in which the cyclodialysis clefts had closed and the tension had become

elevated. For the eyes with normal tensions at the time of the first return visit, the interval between operation and recurrence of hypertension varied from 1 to 16 weeks, averaging 5.8 weeks.

Closure of a previously open and functioning cyclodialysis cleft, as a result of subsequent cataract extraction, is to be expected but does not always occur. In one of the successfully operated cases in this series, a cyclodialysis was done in January, 1938, after an unsuccessful trephination. The cleft remained open, and the tension continued to be normal. In May, 1939, a right extracapsular lens extraction was done. The cleft remained open subsequently and was open when last seen in June, 1946. However, on several occasions since 1944, there have been slight increases in tension to around 30 mm. Hg (Schiotz). The pocket is unquestionably decreasing in extent, but this cannot be determined gonioscopically. A second patient, not of this series, had had an iridectomy performed on the left eye in 1935. This was followed by a trephination in 1937, and later by a cyclodialysis during the same year. A patent cyclodialysis cleft was visible. An intracapsular lens extraction was done in February, 1946. The tension has remained normal since then. The cyclodialysis cleft has remained patent.

COMPLICATIONS OF CYCLODIALYSIS

The complications of the cyclodialysis operation may be divided into early and late groups. The early complications include surgical complications such as failure to cut all the scleral fibers in making the incision, episcleral hemorrhage, hemorrhages into the anterior chamber and vitreous, lacerations of Descemet's membrane, iridodialysis, subluxation of the lens, lens injury,^{19, 41, 43, 45} perforation into the vitreous, and iridocyclitis.^{19, 43} The late complications are hypotony,⁴⁰

TABLE 2
INCIDENCE OF HYPHEMIA IN SUCCESSFUL AND UNSUCCESSFUL CASES OF CYCLODIALYSIS OF
PRIMARY AND SECONDARY GLAUCOMA (FOLLOWING CATARACT EXTRACTION)

Hemorrhage in Anterior Chamber												
	No Hemorrhage	Hemorrhage at Operation		Postoperative Hypphemia Only							Total Fresh Hemorrhages Increasing Hypphemia	
		Anterior Chamber Filled	Slight Hemorrhage	First Noticed 1st Day	First Noticed 2nd Day	First Noticed 3rd Day	First Noticed 4th Day	First Noticed 5th Day	First Noticed 6th Day			
Primary Glaucoma (total 65) 34 successful	16	2	5	6	4	1						5
31 unsuccessful	9	4	8	5	3	1					1	6 (2 full)
Secondary Glaucoma following Cataract Surgery (total 56) 23 successful	9	0	6	3	1	2		1	1			5 (3 full)
33 unsuccessful	6	5	3	8	5	4		1	1			10 (6 full)

retinal detachment,³⁰ opacities of the cornea, ecstasia of the operative scar, cataract formation, changes in refraction,^{19, 41, 43, 45} and closure of a previously patent cleft.

EARLY COMPLICATIONS

Of the early complications, the hemorrhages and lacerations of Descemet's membrane are the only ones which do not depend entirely on the operator's skill and care. McPherson⁴⁰ found anterior-chamber hemorrhages in 52.9 percent of 140 eyes at the time of operation, and an additional 6.5 percent at the time of the first dressing. Vitreous hemorrhages occurred in 5.7 percent of the cases he reported. He also found lacerations of Descemet's membrane in 5 percent. These lacerations rarely interfere with visual or tonometric results. The intraocular hemorrhages are one of the chief causes of closure of well-formed cyclodialysis clefts. The hemorrhages may be from the ciliary body or iris; or from vessels that pass from the ciliary body to the sclera which the spatula will sever, if these vessels are present. For this reason, and in order to prevent severe pain from the pulling on nerve loops, the horizontal meridian should be particularly avoided during the operation.

I reviewed the hospital records of all the patients in the follow-up series discussed herein to determine the relation between the incidence of hyphemia and the successful outcome of the operation (table 2). The incidence was probably greater than stated, especially since inadequate notes were found in some cases. Hyphemia occurred in 18 (52.9 percent) of the successful primary glaucoma cases and in 22 (70.9 percent) of the unsuccessful ones. In the secondary glaucoma cases following cataract operations, 14 (60.8 percent) of the successful ones, and 27 (81.8 percent) of the

unsuccessful ones had hyphemia. It is apparent that hyphemia does not preclude success, but it is also true that lack of success is associated with a greater incidence of hyphemia. In the total of 121 cyclodialyses, hyphemia occurred in 56.1 percent of the successful cases and 76.5 percent of the unsuccessful ones. The incidence of fresh hemorrhages first occurring from 2 to 11 days postoperatively is also somewhat higher in the unsuccessful cases than in the successful ones.

In order to avoid unnecessary trauma and a too large cleft, which might result in hypotony, I formerly advocated^{35, 36} a decrease in the extent of sweep of the cyclodialysis spatula. However, I have now reverted to a sweep of 120 degrees, still avoiding the horizontal meridian. The inverse cyclodialysis of Blaskovics⁴⁶ is preferable since it tends to reduce trauma.* When the eye is aphakic, the operation is done below. In nonaphakic eyes, the upper quadrants are preferred, in order to keep any hyphemia away from the cleft. When the cleft is made below, the patient is kept lying on one side after the operation.

In order to prevent postoperative closure of the cyclodialysis cleft, the use of physostigmine immediately after the operation and in the early postoperative period is recommended. In addition, I have found air injection helpful. After completing the cyclodialysis sweep, a blunt lacrimal needle attached to a syringe is inserted through the scleral in-

* The Blaskovics operation consists of a horizontal incision in the conjunctiva and Tenon's capsule at the level of the insertion of the superior rectus tendon, a vertical incision in the sclera extending 4 mm. from the insertion of that muscle toward the limbus, with the perforation 1.5 mm. long about 7 mm. from the limbus, and a sweep of 110-115 degrees with Elschsig's spatula. The insertion of the ciliary body is thus severed from behind forward. This operation may be applied to any meridian.

cision into the supraciliary cleft up to the chamber angle, and any aqueous present is withdrawn. The syringe is then partly filled with air which is then injected into the anterior chamber.

One may prefer to do both the dialysis operation and the air injection through the spatula devised by Randolph⁴⁷ who was the first to use air injection after cyclodialysis. After air injection, the cleft can usually be seen directly through the cornea. The air bubble pushes the iris and ciliary body backward, thus tending to keep the cleft open. The bubble persists for four days with usually some remnant visible on the fifth or sixth days. I have been unable to evaluate separately the effect of each factor in the operation in my own cases. However, the combination of factors has certainly improved my own results.

LATE COMPLICATIONS

The late complications with which we are most concerned are cataract formation and changes in refraction in nonaphakic eyes, and closure of a previously patent cleft in both nonaphakic and aphakic eyes.

Cataract formation after cyclodialysis is probably related to hypotony.⁵⁴ Stein⁴² reported 20 instances of cataract, which occurred in 24 percent of the hypotonic eyes in the group of private patients he studied. Statistics concerning cataract formation are difficult to evaluate because one cannot be certain that late cataract formation would not have occurred if the operation had not been done. Many of these cataracts probably result from a progression of previously incipient opacities. Early cataract formation should probably be attributed to operative trauma. Salus noted posterior subcapsular opacities which he considered characteristic and found mostly in hypotonic eyes. He reported 19 instances of

cataract formation in 350 eyes.

The changes in refraction after cyclodialysis have been discussed by Salus,¹⁹ Stein,⁴² and Bunge.⁴³ Salus found an increase in refraction in 43 instances and a decrease of refraction, 11 times in 350 eyes. Bunge found increased refraction amounting to from 1 to 5 diopters in 13 eyes of patients with simple and chronic congestive glaucoma. Stein reported an increase in refraction of 0.5 to 4 diopters in 24 cases and a decrease in refraction, three times. The increased refraction was in the nature of a decrease in hyperopia in 12 cases, an increase in myopia in eight, and a change from hyperopia to myopia in four. He believed the change was due to the stretching of the zonule.

I reviewed the records of a series of 48 operated eyes and 33 unoperated eyes with primary glaucoma to determine the amount of refractive change after cyclodialysis, as compared with the change after other operations and with refractive change in unoperated glaucomatous eyes. The results are shown in Chart 1.

The 48 operated eyes consisted of 14 following iridectomy, 12 after cyclodialysis, 11 after trephination, and 11 after iridencleisis. These patients were from the private practice of Dr. Harry S. Gradle and Dr. S. J. Meyer. All of the operated cases were selected on the basis of preoperative visual acuity of 20/25 or better and not less than 20/40, during the first year after operation. Only patients who had recently been refracted were included.

As for the 11 iridencleisis cases, the short one-year period of follow-up was due to the fact that most of the operations of this type were relatively recent. In the case of cyclodialysis, the one-year follow-up period was due in part to cataract formation and in part to the fact that secondary operations were relatively frequent so the cases could not

longer be included in this study.

In all types of operation, an average increase of refraction of 0.37 to 0.75 diopters occurred during the interval between the preoperative examination and the first postoperative examination.

In every group the average refraction

ination one year after operation in the cyclodialysis group. In the trephination group, the greatest postoperative change occurred in this small series.

Of the 12 cyclodialysis cases, two decreased slightly in refraction—in one case, only 0.25 diopters; in the other, 0.50 di-

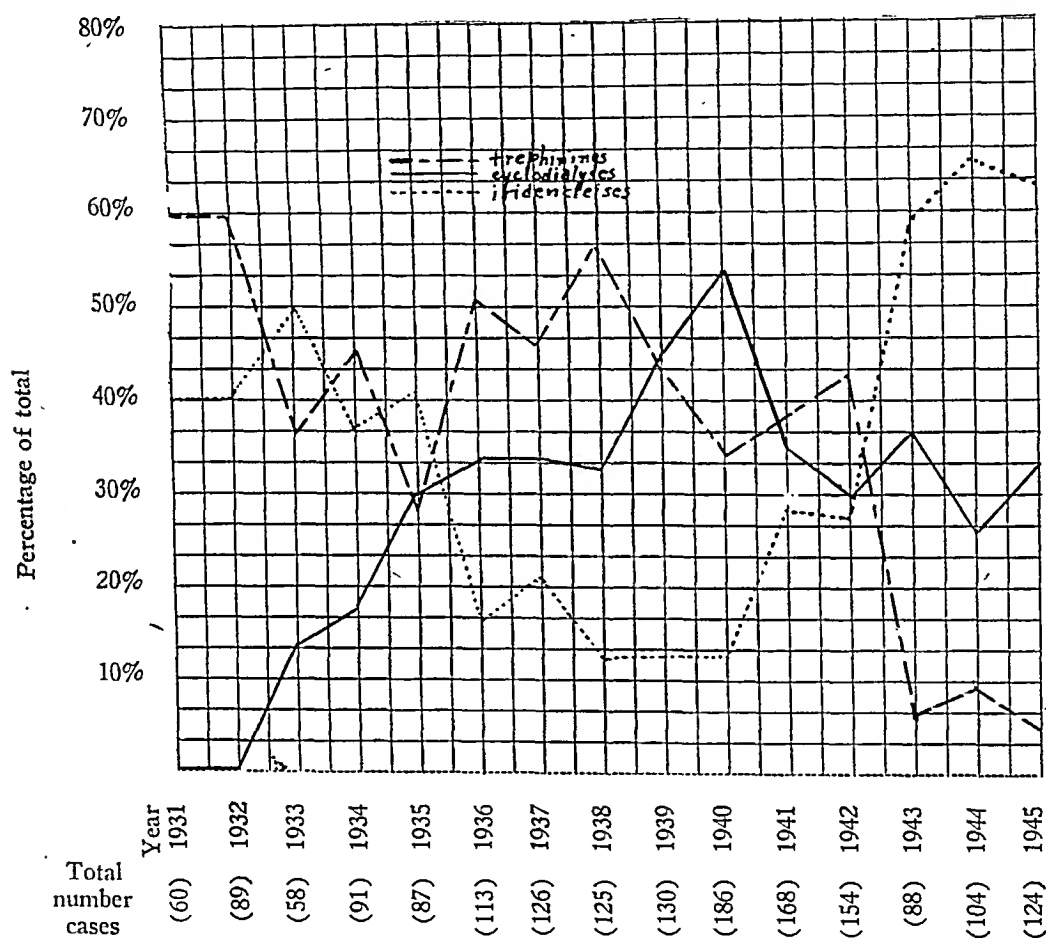


Chart 1 (Sugar). A comparison of cyclodialyses, trephinations, and iridencleises at the Illinois Eye and Ear Infirmary, Chicago, 1931 to 1945.

continued to increase as time passed. In the iridectomy group the change was least of all, reaching only 1.0 diopter after six years. The increase of 2.5 diopters more after eight years and of 4.75 more 10 years after operation must be considered as unrelated to the iridectomy procedure itself. There was relatively little difference between the first postoperative examination and the exam-

opters. One showed no change. The nine remaining cases increased in refraction up to 2.5 diopters. Nine of the 12 had been hyperopic. Three of these became myopic.

Closure of a previously patent cyclodialysis cleft is one of the most serious of the late complications. It has been the cause of most of the objections to the operation. The duration of successful re-

sults after cyclodialysis has been the subject of several papers.⁴²⁻⁴⁴ Stein⁴² found, in a total of 120 cyclodialyses which had been done on private patients of Elschsig, that an average of 72 percent of simple glaucoma and 70 percent of chronic uncompensated cases had lasting success. In one case success had lasted

sults—one case, 11 years; 3 over 6 years; 7 between 1½ and 4 years; and 2 were observed less than one year. In the second group, that of secondary glaucoma of various types, not including postcataract glaucoma, there were seven cases. In one, the tension remained normal for 13 years. The third group consisted of 34

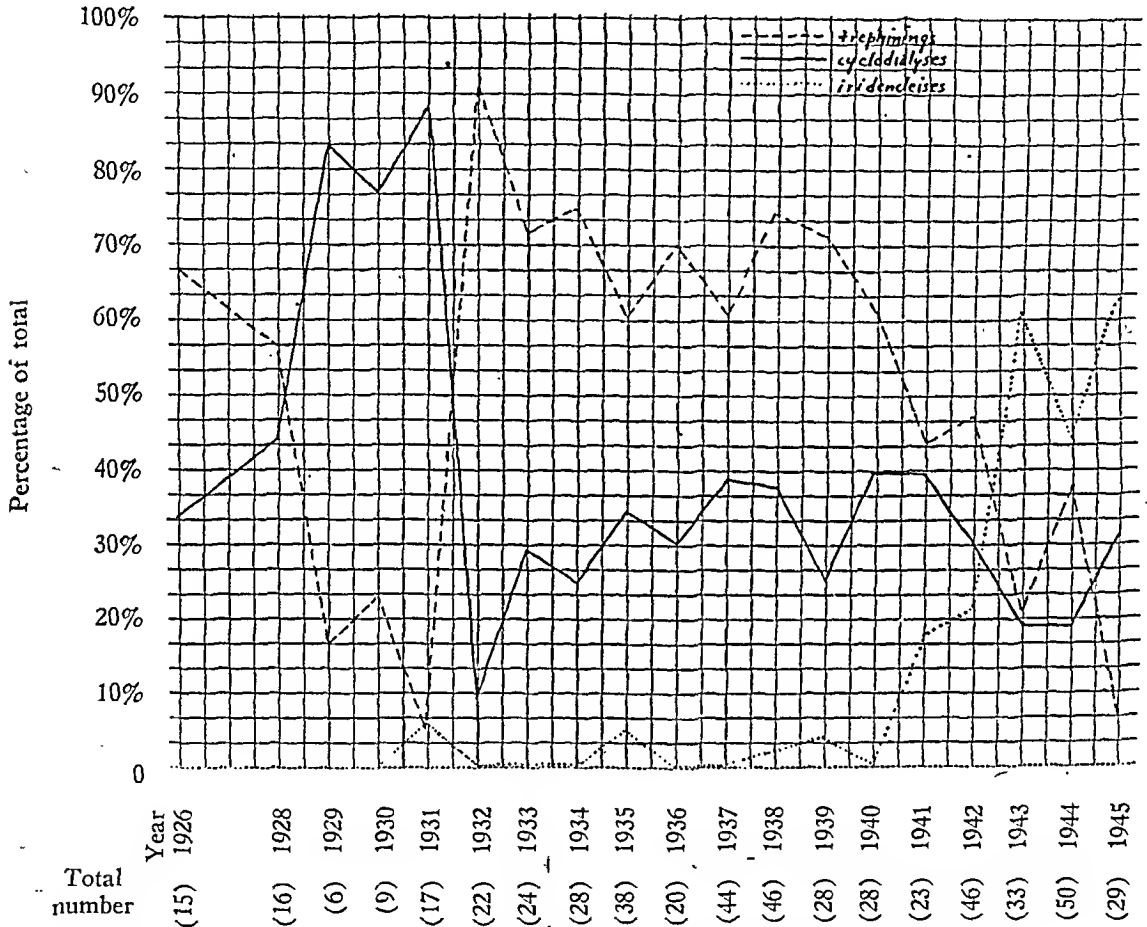


Chart 2 (Sugar). A comparison of cyclodialyses, trephinations, and iridencleises at the Michael Reese Hospital, Chicago, 1926 to 1945.

20 years. Of 393 cyclodialyses in clinic patients, he reported success in 79 percent of simple glaucoma cases and 68.8 percent of uncompensated glaucoma cases. Bunge⁴³ found 68.9 percent success in simple and congestive glaucoma.

Hausmann⁴⁴ divided her cases into five groups. In the first group of 21 cases of postcataract glaucoma, 13 had lasting re-

sults of primary chronic glaucoma in which a cyclodialysis was the only operation. Eight of these were normal over a 4-year period. Two of the latter had normal tension and vision for 14 years. Seven were normal up to three years, and 12 were normal during an observation period of less than a year. The fourth group consisted of 22 cases in

which cyclodialysis was followed by other operations. Thirteen of these cases were helped. The fifth group was made up of 21 cases in which cyclodialysis followed other operations. In one case the tension remained normal for 14 years, and, in another, 9 years.

cent of all glaucoma operations in 1923, remained about 50 percent, then rose to over 60 percent in 1933. Trephinations during the same period, 1918 to 1933, fell from 40 percent of all glaucoma operations to nearly zero in 1923, rose slightly to 10 percent in 1939, and re-

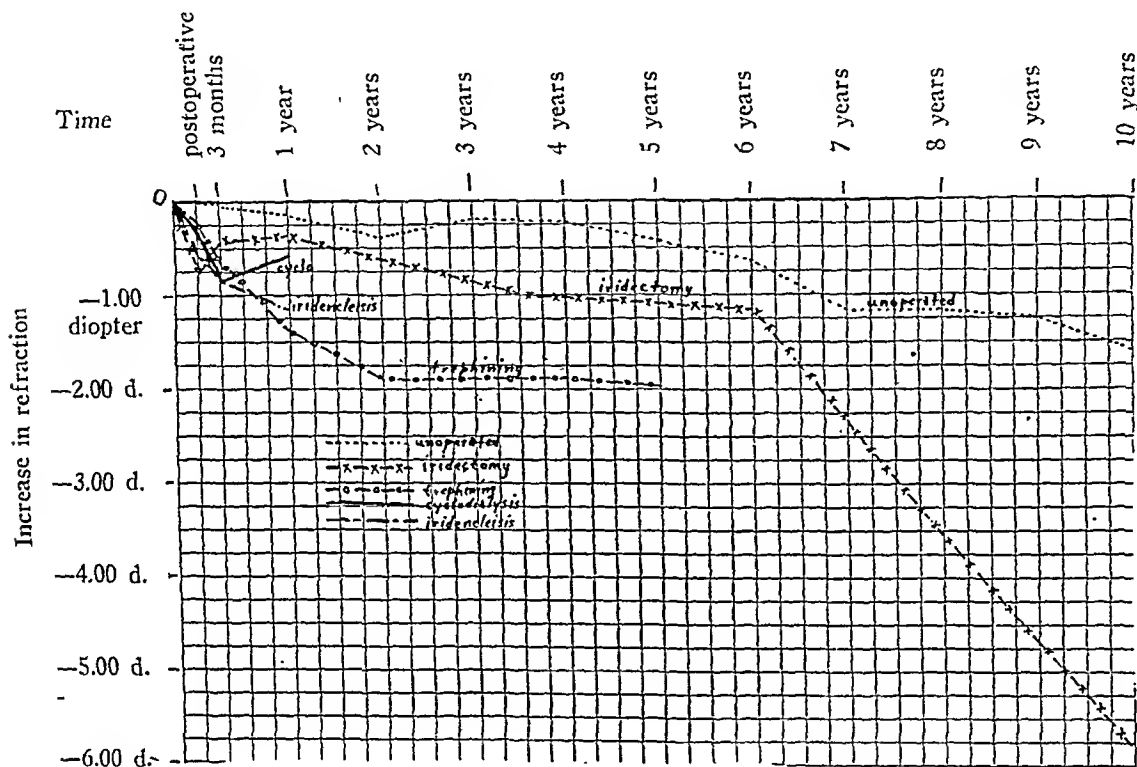


Chart 3 (Sugar). Refractive increase (averages) in unoperated glaucomatous eyes and after various operations for glaucoma.

Louhala and Teräskeli⁵⁴ reported a preliminary good result in 72 percent of cyclodialyses for simple glaucoma. After a period of 1 to 10 years of follow-up, good results were found in only 52 percent of the follow-up cases.

The frequency of employment of cyclodialysis as compared to other operations in the treatment of glaucoma gives an indication of the opinion held generally as to its efficacy. Von Grosz's³⁸ statistics concerning the Budapest Eye Clinic indicate that the cyclodialysis operation rose from zero in 1918 to over 50 per-

cent at about 10 percent until 1943. Iridectomy had been the most frequent in proportion to the increased frequency of cyclodialysis.

Bunge cites similar statistics from other European authors of the period, 1918 to 1931. Similar but more recent results from the University of Helsinki are worthy of mention. Louhala and Teräskeli reported that, until 1930, trephination was the most common glaucoma operation in Finland. Iridencleisis came next in frequency. Between 1931 and 1942, cyclodialysis was the most frequent

operation (206 cyclodialyses in a total of 520 operations for glaucoma). Iridencleisis came next (165), then iridectomy (140), and lastly, trephination (5).

A review of the number of cyclodialysis operations compared to trephinations and iris-inclusion operations performed during the past 15 to 20 years at the Illinois Eye and Ear Infirmary, a state institution where no private work is done, and at Michael Reese Hospital, a private institutions where the eye patients were in large part from the practice of Dr. H. S. Gradle, gives an indication of the trends in glaucoma surgery in Chicago. The results of this review are shown in Charts 2 and 3. It would be interesting to compare these results with those of other institutions, especially those elsewhere in the United States.

It is worth noting that since 1940, the iris-inclusion operations have comprised about 60 percent of glaucoma operations (excluding iridectomy) in both institutions. In 1945, cyclodialysis comprised slightly over 30 percent of these glaucoma operations in both places. The graphs indicate considerable variation, however, in the trends between each institution. This was noted also among the six individual services of the Infirmary, indicating the importance of personal preference by each surgeon for a particular procedure.

The indications for cyclodialysis have changed remarkably during the period in which the operation has been in use. In 1914, the contributor to the *American Encyclopedia of Ophthalmology* wrote:²⁹ "The real indication for it (the cyclodialysis operation) is the impossibility of performing iridectomy from the presence of very high intraocular pressure and absolute glaucoma which has progressed far."

Meller⁴⁸ early preferred cyclodialysis to iridectomy in certain cases because it

was decidedly less dangerous. The procedure was considered to be indicated in very hard eyes with very shallow chambers; in hemorrhagic glaucoma; and in those cases in which the fellow eye had been lost through malignant glaucoma or through severe hemorrhage following iridectomy; in aphakic eyes with fluid vitreous; and in hydrophthalmic eyes.

Elschnig considered cyclodialysis a valuable addition, especially for simple glaucoma, hydrophthalmos, secondary glaucoma, or when iridectomy could not be done or had failed. Waldstein¹⁵ favored its use in simple glaucoma, and in secondary glaucoma due to luxated or subluxated lenses. In 1922, Elliot⁴⁹ considered cyclodialysis to have gone out of favor in hydrophthalmos.

In 1924, Fuchs⁵⁰ considered that the operation should be reserved for cases in which other operations have failed or proved fatal to the other eye, or cases in which iridectomy is difficult or dangerous. Meller,⁵¹ in 1923, listed the indications for cyclodialysis as: (1) the early stages of glaucoma; (2) acute glaucoma in which iridectomy is difficult and dangerous; (3) patients who have lost one eye from malignant glaucoma or from severe hemorrhage after iridectomy, and also in old, restless people; (4) secondary glaucoma, including that due to anterior synechia in which the tension increased after cataract extraction.

Von Grosz,⁵² in 1932, believed the indication for cyclodialysis to be "chronic inflammatory glaucoma." Gradle,²⁷ in 1920, considered the operation distinctly contraindicated in acute glaucoma of an exudative or inflammatory type, and in cases where immediate operation is desirable. He later,⁵³ in 1931, considered the indications for cyclodialysis to be: (1) simple noninflammatory glaucoma of the type just beyond the control of miotics; (2) simple glaucoma with high intraocu-

lar pressure and a visual-field defect extending to within 10 degrees or less of the fixation point; and (3) after unsuccessful but technically correct iridectomy.

McPherson⁴⁰ in his recent report from the Wilmer Institute advocated Gradle's dictum regarding the use of cyclodialysis in chronic simple glaucoma without inflammatory reaction. However, his report of 42-percent successful results in 45 cases of chronic simple glaucoma and in 35.9 percent of 39 cases following cataract extraction, which is similar to the results in my own series, does not appear to be as good as the reports made for trephination and iridencleisis for simple glaucoma.

Thus, although successful cyclodialysis in simple glaucoma gives an ideal physiologic result, theoretically, the percent of success is less than after the filtering operations. There are two exclusive indications for the operation: (1) glaucoma in aphakic eyes, no matter whether simple glaucoma, obstructive glaucoma due to complete anterior synechias, resulting from cataract operation, or glaucoma capsulare; and (2) secondary glaucoma due to posterior subluxation of the crystalline lens. In addition cyclodialysis may be successful in certain instances of narrow-angle glaucoma where a previous iridectomy has been unsuccessful. In simple glaucoma, cyclodialysis may be used, even with only about 45-percent success, since the operation does not carry with it the danger of late infection and since it may be repeated without damage to the integrity of the eye.

CONCLUSIONS

1. A relatively small number of successful cyclodialysis operations, after varying periods of time, become failures or relative failures. The original 47.1 percent of success in a total of 121 cyclo-

dialyses of all kinds, observed up to five years, was reduced to 38.8 percent after an additional six-year period.

2. The "all-or-none" relationship between success of the cyclodialysis operation and the formation of a supraciliary cleft is a fact, but must be modified from a gonioscopic view, since the depth of a cleft cannot always be determined by this technique.

3. Cyclodialysis operations may remain successful in some instances, in spite of subsequent cataract surgery.

4. An increase of refraction usually occurs after cyclodialysis, as it does following other glaucoma operations.

5. The trend in the use of the cyclodialysis operation in two Chicago hospitals has become somewhat less frequent in recent years, particularly in comparison to the recent increase in the use of the iridencleisis operation.

6. The two exclusive indications for cyclodialysis are: (1) glaucoma in aphakic eyes; and (2) secondary glaucoma due to posterior subluxation of the crystalline lens. In addition, the operation may be successful in cases of shallow-angle glaucoma where a previous iridectomy has been unsuccessful. In simple glaucoma, the percentage of success is relatively low, but the operation has certain advantages.

7. The percentage of success in the formation of clefts may be improved by separating the ciliary body from the scleral spur along a third of the angle circumference, preferably by the use of the Blaskovics technique. The use of eserine and the keeping of the patient in such a position after operation that any hyphemia will not settle in the cleft are advocated. The injection of air into the anterior chamber through the scleral incision by way of a lacrimal needle is suggested as an additional aid.

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INVERSE CYCLODIALYSIS*

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The success of a cyclodialysis operation in controlling glaucoma is entirely dependent upon the production of a permanent cleft at the anterior-chamber angle through which aqueous can enter the suprachoroidal space. This fact was demonstrated microscopically by Elschmig,¹ in 1932, and confirmed gonioscopically, in 1936, by Barkan, Boyle, and Maisler,² and by Clarke,³ in 1941. Any variation in technique is well worth while, if it makes more certain the production of this cleft and the prevention of hemorrhage. Such a variation is the inverse cyclodialysis of Blaskovics.

The operation of cyclodialysis was introduced in 1905 by Heine⁴ and popularized in 1920 by Salus,⁵ using the same fundamental procedure as is now employed routinely. Mauksch⁶ has added suprachoroidal iridotaxis to the routine cyclodialysis. Troncoso⁷ has suggested the use of magnesium implants which, by producing hydrogen bubbles in the cleft, help to keep it open. Wootton⁸ combined an iridectomy with the dialysis. An increasing number of surgeons are introducing air into the anterior chamber upon the completion of the cyclodialysis. The inverse maneuver is a fundamental change in technique devised by Blaskovics⁹ and described by him in Szemeszet, in 1935. One other article by Pereira¹⁰ in the Spanish literature reports using the operation successfully in one case. Other than this, no mention of the technique has been found in the literature, although an occasional surgeon in this country has used the method.

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EXPERIMENTAL PROCEDURE

In 1944, Dr. Owen Dickson and I conducted a series of animal experiments, using dogs, cats, rabbits, and monkeys, to determine the effect of air injection into the anterior chamber following cyclodialysis. A cyclodialysis in a dog is complicated by extensive hemorrhage from the scleral incision. In order to control bleeding, a radial scleral incision was tried rather than the usual tangential variety. Since this incision paralleled the scleral blood vessels, there was a material decrease in bleeding.

Because it was found difficult to introduce an Elschmig spatula directly into the anterior chamber through the radial incision, the inverse technique was tried. The spatula was inserted laterally between the sclera and the pars plana of the ciliary body to the full extent of the spatula. The blade was then swept forward into the anterior chamber, effecting the separation in a direction opposite to that of the usual method; hence, the term, "inverse cyclodialysis."

In dogs, cats, and monkeys, the dialysis could be done more easily and with less force being applied to the spatula than in the routine type. There also seemed to be less anterior-chamber hemorrhage by this approach, even when the scleral incision was made tangentially.

In rabbits, a cyclodialysis is difficult to accomplish because of the friability of the iris and its intimate attachment to the sclera. Almost invariably the tip of the dialysing spatula appeared behind the iris when the routine approach was used. However, with care a cyclodialysis could be performed by the inverse approach.

Upon checking the microscopic anatomy of the ciliary body and its attachment to the sclera in glaucomatous and nonglaucomatous human eyes, it seemed that the inverse approach was a logical one. As shown in Figures 1 and 2, the fibers of the ciliary body run forward and are practically continuous with the trabecular fibers overlying Schlemm's canal. Part of the scleral spur actually lies in front of the canal. The angle of the anterior chamber does not end at the point of ciliary-body attachment at the scleral spur, but actually points into the ciliary body itself. Consequently, when an Elschnig spatula is pressed into the angle in the routine manner, it has to tear through anterior ciliary body, in some instances, before reaching the suprachoroidal space. This trauma would cause increased bleeding. A clot lying between the raw surfaces of a damaged ciliary body would encourage fibroblastic invasion which would tend to seal up the intended cleft. Thus, even in eyes without anterior synechiae, the inverse approach seems to follow a natural cleavage plane.

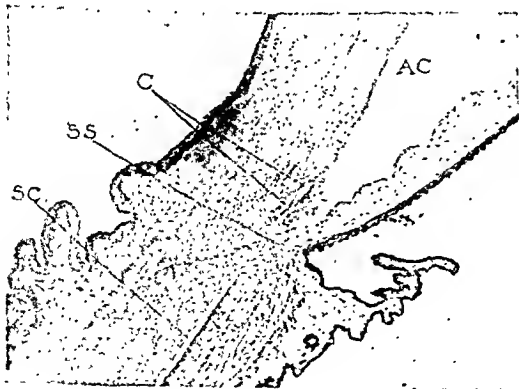


Fig. 1 (Shaffer). Normal open angle. AC, Anterior chamber; C, Schlemm's canal; SS, Scleral spur; SC, Suprachoroidal space.

This should help to dialyse the ciliary body from the scleral spur at the trabeculum with a minimum of trauma.

In the eyes with extensive anterior

synechiae (fig. 3), such as occur in late glaucomas and particularly in postcataract glaucomas, the chances for an atraumatic and successful dialysis by the usual

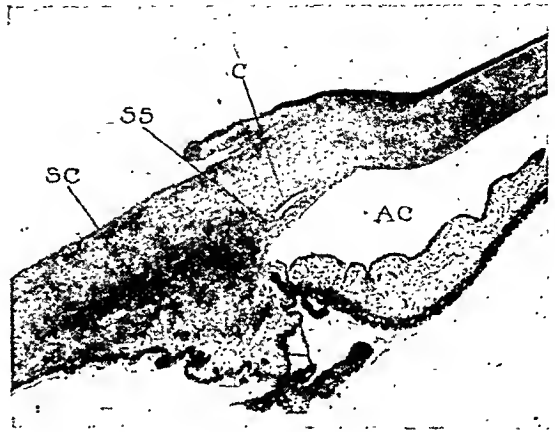


Fig. 2 (Shaffer). Normal open angle showing how easily anterior ciliary body can be torn by dialysing spatula approaching suprachoroidal space from anterior chamber. AC, Anterior chamber; C, Schlemm's canal; SS, Scleral spur; SC, Suprachoroidal space.

method seem to be definitely less. If, as the spatula is swept toward the angle, it encounters a firm synechia, there is a tendency for the iris to fold back in front of the spatula toward the posterior chamber. This might result in an iridodialysis, or merely in a failure to produce a true cleft. By using the inverse method, it would seem probable that the blade of the spatula would follow the line of cleavage between the synechiae and the cornea. One would reasonably expect that there would be less tendency to transfix the iris or to injure Descemet's membrane if the side-sweep of the spatula were employed than if its tip were thrust through the synechiae into the anterior chamber, as in the routine approach.

CASE REPORTS

Case 1. Our first opportunity to use the inverse method in operating on a human being was in a highly unfavorable case seen in January, 1945. This was a

cataract patient with diabetes, which was difficult to control in the hospital and which was frequently uncontrolled under home conditions. She had had an extracapsular cataract extraction with full iridectomy and corneoscleral sutures. An anterior chamber had formed the first day but was collapsed on the second. Efforts to demonstrate a fistula along the incision

tip of a spatula past so broad a synechia to the pupillary area; so the inverse method was tried. The technique was not difficult, and part of the iris was loosened from the cornea. The tension was not controlled, however, and the inverse procedure was repeated. This time, as the spatula swept into the pupillary area, the iris could be seen dropping back into po-

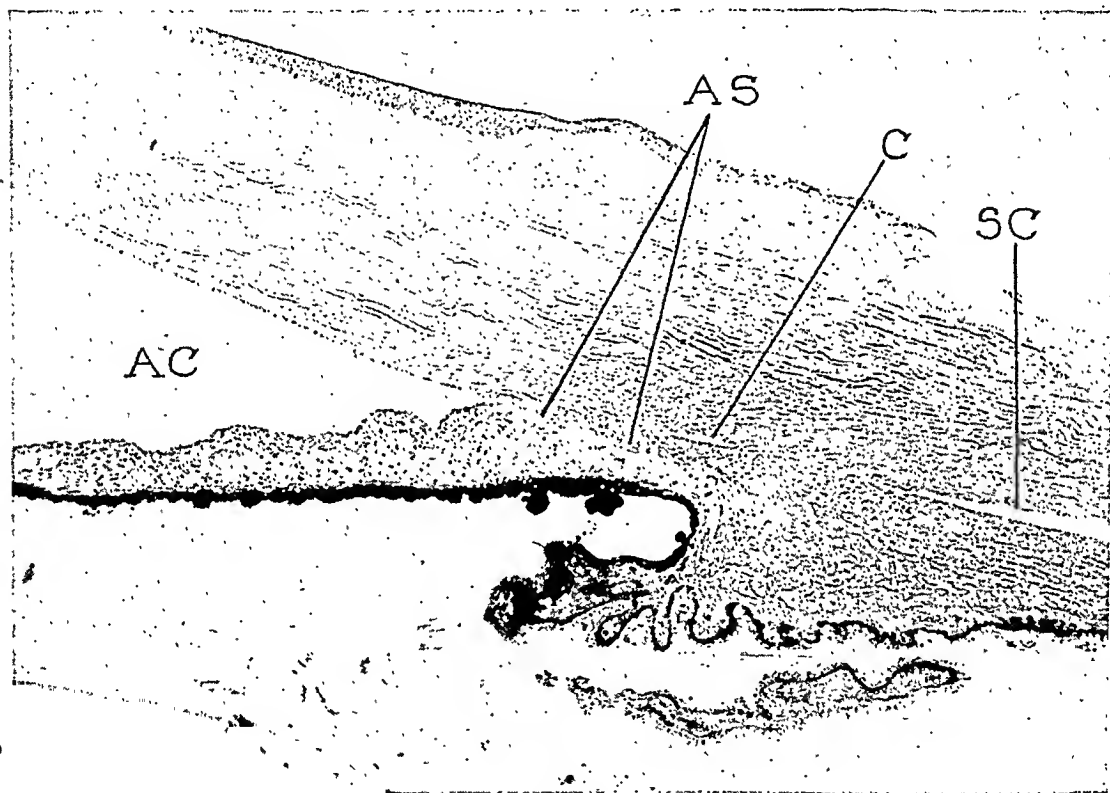


Fig. 3 (Shaffer). Angle showing anterior synechiae. AC, anterior chamber; AS, anterior synechia; C, Schlemm's canal; SC, Suprachoroidal space.

line were unsuccessful. Aqueous could be seen between the cornea and the vitreous face in the pupillary area and behind the iris, but the entire extent of the iris was adherent to the cornea. Air injection between the iris and the cornea failed to free the adhesions. As one would expect, the tension was greatly elevated.

Six weeks after the cataract operation, it was decided to attempt a cyclodialysis. It seemed almost impossible to work the

situation. The anterior chamber was reformed and has persisted. Although the tension remained at 30 mm. Hg (Schiotz), further surgery was not considered because the eye was essentially blind. After waiting several months, this patient's second eye was operated upon for cataract. The operation was uneventful; the incision was carefully sutured; a large air bubble was instilled into the anterior chamber. Again the chamber was shal-

low the first postoperative day, and completely collapsed the second. The iris remained against the cornea even though the vitreous face was pressed back in the pupillary area by aqueous. At the end of one week, an inverse cyclodialysis was performed without difficulty; a large air bubble was injected into the anterior chamber, and a posterior sclerotomy was performed to reduce posterior-chamber pressure. The chamber was restored, and the intraocular pressure remained in the normal zone.

Case 2 was a patient with narrow-angle glaucoma who had had two previous cyclodialyses performed in the usual way. Very small and shallow clefts had been produced. The first one had held the tension at normal for only five months, the second for a year. An inverse dialysis, performed in an untraumatized portion of the angle, produced a large cleft which is functioning well at the present time.

Cases 3 and 4 were patients with wide-angle glaucoma. One was secondary to a subluxated lens; the other to a glaucoma capsulare. In these we combined the inverse with the standard routine, sweeping inversely from the scleral side into the chamber, then completing the other half into the suprachoroidal space in the routine direction. The success achieved in these two cases completed our conversion to the Blaskovics' procedure; for, in both of these cases, the part dialysed routinely had no cleft whatever, and the part done inversely had beautiful clefts!

By July 1, 1946, 21 cases had been operated by the inverse method, and with one exception we have had no reason to question its worth. This one exception was a case of wide-angle, or chronic simple, glaucoma in a man, 47 years of age. The tension, 30 to 40 mm. Hg (Schiotz) in one eye, could not be controlled by miotics. His seemed an ideal case for cyclodialysis. This was done by

the inverse method with a minimum of trauma and bleeding. The following day the eye was stony hard. The conjunctiva was so edematous as to suggest a posterior venous thrombosis. Tension remained over 70 mm. Hg (Schiotz) for two weeks despite the most energetic measures short of surgery. Gradually tension dropped back to 30 mm., leaving a mid-dilated, fixed pupil, corrected vision of 20/30, moderate field loss, a normal fundus, and an unsolved problem. The operative site showed no cleft gonioscopically. Explanation for the failure is lacking.

PRESENT CYCLODIALYSIS TECHNIQUE

1. ANESTHESIA

Premedication consists of nembutal (0.1 gm.) given the night before surgery and repeated the morning of surgery. Usually, morphine sulfate (10 to 15 mg.) is given hypodermically when the patient is called to surgery. Eserine (0.5 percent) is instilled twice before starting the anesthesia in order to keep the pupil miotic. Pontocaine (0.5 percent) is dropped into the eye at 3-minute intervals, 5 times. Meanwhile a Van Lint akinesis, and retrobulbar and subconjunctival injections of 2-percent novocaine and 1:20,000 adrenalin, are given. The retrobulbar injection of 1.5 cc. is used 30 minutes before starting surgery to effect maximum softening of the eye. It also frequently deepens the anterior chamber, making the dialysis easier. Complete anesthesia is essential. If regional block is ineffective, general anesthesia is indicated.

2. SELECTION OF OPERATIVE SITE

That portion of the angle is chosen for cyclodialysis which gonioscopy has shown to be most widely open and most free of anterior synechiae and blood vessels. This permits the dialysis to be done

with a minimum of trauma and bleeding. If there is no choice, the upper temporal quadrant is chosen because of ease of access and because the patient can sit up postoperatively to allow any hemorrhage to run out of the cleft into the bottom of the anterior chamber. Authors usually suggest that the 180-degree meridian be avoided to prevent bleeding from the long posterior ciliary arteries. However, since

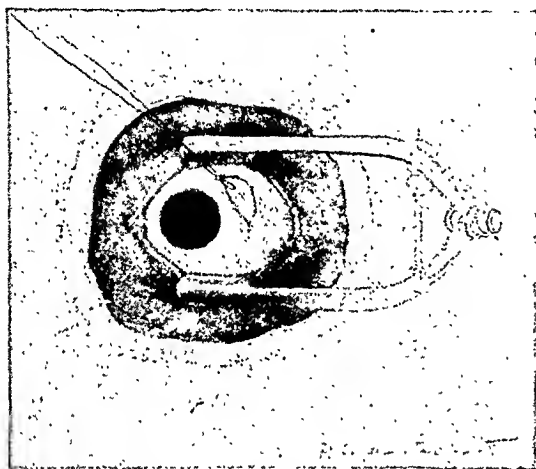


Fig. 4 (Shaffer). Conjunctival incision is 8 mm. from limbus. Scleral incision is 5 mm. from limbus. Traction suture in place.

these enter the posterior portion of the ciliary body, the dialysing spatula should not injure them. We have not seen increased bleeding from this area. The major portion of the dialysis should lie in the quadrant between the muscles to avoid the anterior ciliary arteries, which perforate the sclera 2 to 3 mm. anterior to the tendinous insertions.

3. INCISIONS

A 10-mm. conjunctival incision is made with scissors, 8 mm. from the limbus and parallel to it (fig. 4). The scleral incision should be 4 to 5 mm. from the limbus. It can be made with a No. 15 Bard-Parker blade, or with a keratome. The external incision should measure 4 mm. with a 1.5- to 2-mm. opening into the

suprachoroidal space. It can be placed either radially, as suggested by Blaskovics,⁹ or tangentially in the routine manner.

Since the radial incision has the advantage of running with the scleral fibers, there is less tendency for the wound to gape. It also parallels the blood vessels and reduces hemorrhagic tendencies. If there is any bevel to this radial incision, however, it becomes impossible to reintroduce the spatula under the scleral shelf should a second half-sweep be desired. Therefore, the radial incision should be perpendicular to the sclera, and the tangential one should be bevelled slightly toward the cornea. To avoid a ragged incision through which the introduction of a spatula is difficult, the cutting instrument should be held in the same plane at all times, and the perforation should be made in as few strokes as is consistent with safety. If any severe scleral bleeding occurs, it must be controlled by high-frequency coagulation, or by actual cautery. When the sclera has been completely incised, it is possible to depress one lip of the scleral wound by pressing upon it. The black ciliary pigment can then be seen in the depths of the incision.

4. FIXATION

If a double inverse dialysis is contemplated, the tangential incision is usually chosen because of the greater ease of manipulation. When the scleral cut is half completed, a 4-0 Anacap suture is passed through the corneal lip of the incision. If the first bite is not a strong one, a second turn through the sclera is made. This then serves as a traction suture in making the dialysis. If a radial incision is made, contemplating only half of a dialysis, the traction suture is placed in the lip on the side of the contemplated dialysis. Although Elschnig forceps can be used for fixation, they have an unhappy faculty of

loosening their grip at a critical moment in the operation.

5. THE DIALYSIS

After the perforating incision is completed, the Elschnig spatula is placed in a horizontal position with the tip resting on one lip of the wound. When this is depressed, the ciliary body is pressed away from the under surface of the opposite scleral lip, and the spatula can be introduced with ease. If there is any re-

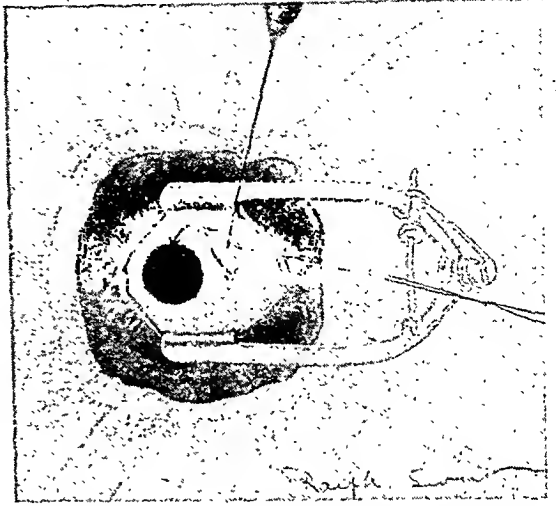


Fig. 6 (Shaffer). Elschnig spatula in suprachoroidal space parallel to limbus.

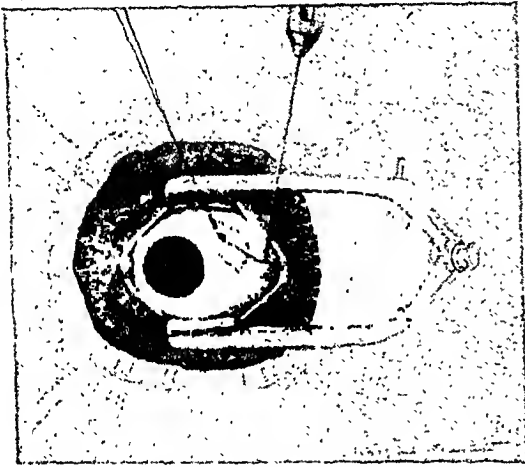


Fig. 5 (Shaffer). Introduction of Elschnig spatula into suprachoroidal space. Traction suture lifting anterior scleral lip.

depressed. When the blade is completely out of sight under the sclera, it is slowly rotated (fig. 7) toward the anterior chamber. Resistance is felt when the scleral spur is reached. The operator should accomplish the dialysis with great care and deliberation. As the tip and side of the blade come into view at the angle, one must avoid pressing it upward against the cornea, or backward against the stroma of the iris. Rotation is continued until the blade is in the middle of the anterior chamber. It is then quickly

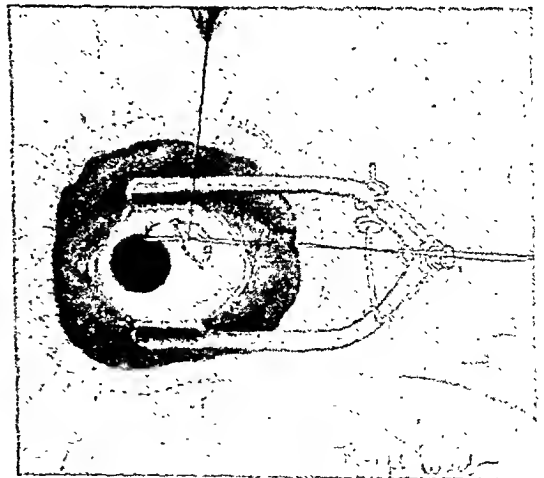


Fig. 7 (Shaffer). Rotation of spatula past attachment of ciliary body to scleral spur into the anterior chamber.

sistance, it is because scleral strands remain at the depths of the wound, and these must be severed. As in Figures 5 and 6, the blade of the spatula is pressed gently forward along the inner surface of the sclera parallel to the limbus. Small side-to-side movements are made as the blade is advanced, both to avoid wrinkling the pars plana of the ciliary body in front of the spatula and to keep track of the tip of the blade which can usually be seen through the sclera. When the blade is introduced half way, considerable resistance is sometimes encountered. This means that the operator is holding the spatula too firmly against the inner sclera, and that the point must be slightly

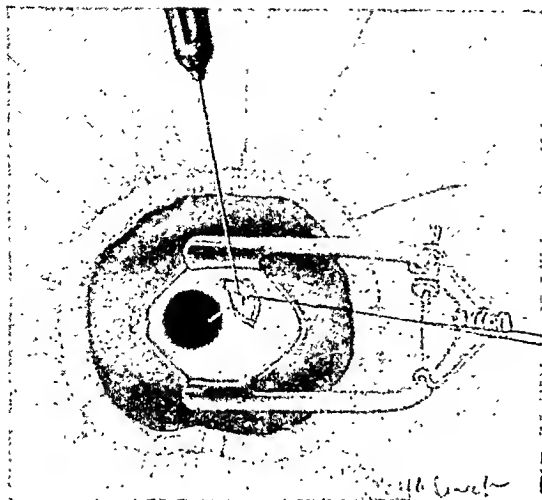


Fig. 8 (Shaffer). Completion of one half the dialysis. Spatula is withdrawn in this position.

removed (fig. 8). A second spatula can then be inserted in the opposite direction (fig. 9), to double the size of the cyclo-dialysis, if desired.

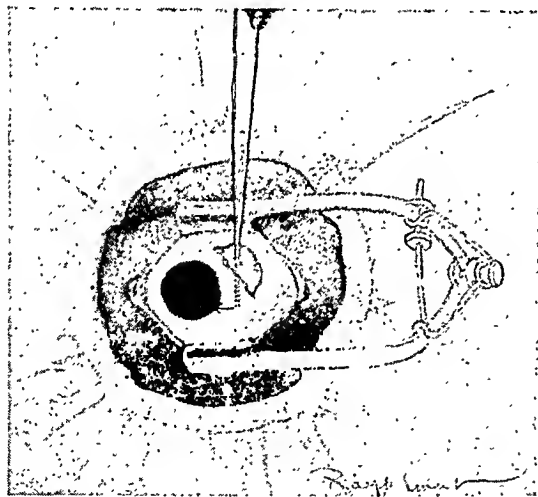


Fig. 9 (Shaffer). Introduction of the Elschnig spatula in the opposite direction. It is swept into the anterior chamber as in Figures 7 and 8.

6. AIR INJECTION

As pointed out by Hughes and Cole,¹¹ air in the anterior chamber is well tolerated. We have been using air injections routinely following cyclo-dialysis for over

two years. We have been impressed by the arrest of hemorrhage as soon as the air is introduced into the anterior chamber. Doubtless this is due to the restoration of intraocular pressure, which reduces capillary bleeding. Filtered air is placed in a small Luer or anterior-chamber irrigator to which is attached a slightly flattened lacrimal needle (fig. 10), bent to correspond to the curve of the Elschnig spatula, but only 6 mm. in length. This is introduced as promptly as

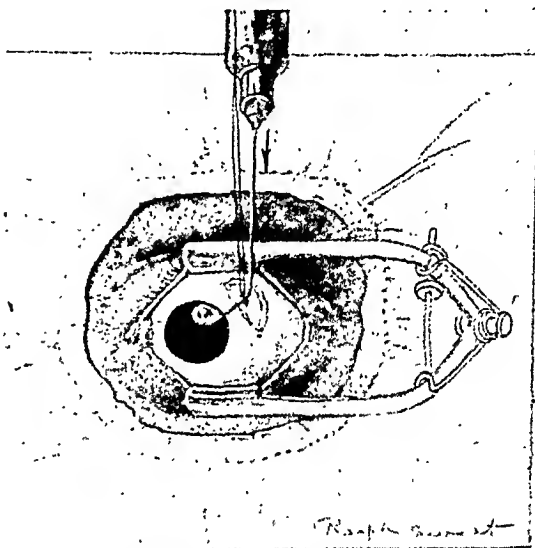


Fig. 10 (Shaffer). Injection of air into anterior chamber with a 2-cc. Luer irrigator and a lacrimal needle.

possible after the dialysis and sufficient air is injected to restore the normal depth of the anterior chamber. In one of our cases the chamber was quite shallow, and in our enthusiasm to ensure an open cleft, too much air was instilled. This produced a deep chamber and increased the intraocular pressure. When the needle was removed, the tangential incision gaped slightly, and a small choroidal herniation appeared, thinned out, and was followed by a small bead of vitreous. Fortunately, a good cleft and a fine functional result were obtained, despite the accident.

7. CLOSURE

The conjunctiva is closed with interrupted black silk sutures (fig. 11), which can be removed on the fifth postoperative day.

8. POSTOPERATIVE ORDERS

The patient's head is held with the dialysed portion of the eye upward. The air in the anterior chamber then gravitates up into the cleft, helping to hold it open. At the same time, any blood in the cleft can run out into the dependent part of the chamber.

Medication is used as indicated. If the pupil is large, it is constricted to pull the iris away from the cleft. If it is small, it must be dilated briefly on the second or third day with 2.5-percent neosynephrin to avoid permanent posterior synechiae. Such synechiae must be guarded against for several weeks, as there is almost always a moderate postoperative iritis. In rare instances, this may persist for months.

Gonioscopy, done as soon as the eye is quiet enough to tolerate the procedure, yields information as to the safety of proceeding with mydriatic therapy if an iritis is present. A definite prognosis can

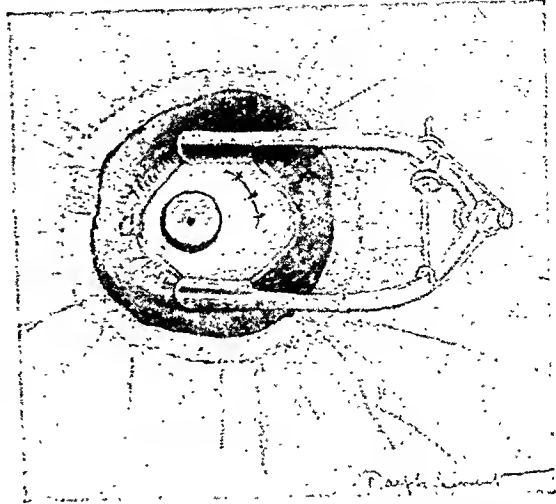


Fig. 11 (Shaffer). Air bubble in the anterior chamber. Conjunctiva closed with black-silk suture.

usually be given in two or three weeks. If the cleft is shallow or short in extent, the outcome may be doubtful, but a wide, open cleft usually means success. When there is no cleft, the operation has been a definite failure.

STATISTICS

Our series of 21 inverse cyclodialyses is too small to be of any great statistical value, but each case has been carefully classified and has been followed for six months to two years postoperatively, so

TABLE 1
STATISTICS IN VARIOUS TYPES OF GLAUCOMA

	Number of Operations	Successes	Percent
Narrow Angle			
Routine	18	9	50
Inverse	3	2	66
Wide Angle			
Routine	17	12	70
Inverse	9	8	88
Postcataract			
Routine	11	3	27
Inverse	9	6	67
Total			
Routine	46	24	52
Inverse	21	16	76

that the prognosis is quite definite. As a control, 46 similarly classified glaucoma cases, operated by the routine technique, have been used. A cyclodialysis which reduced the tension below 25 mm. Hg (Schiøtz) for one year, or for six months if a good cleft was visible gonioscopically, has arbitrarily been classed as a success. To date none of the inverse group which has been classed as a success has had a secondary rise in tension.

Blaskovics reported a total of 53 inverse cyclodialyses and compared them statistically to 53 similar cases operated by the routine Heine-Elschnig technique. He states that but few of his patients returned for follow-up examinations. His immediate statistics record successful normalization of tension in 67 percent of cases done by his inverse technique, as compared to 48.3 percent successfully operated by the other method. As in our experience, he found the dialysis to be

more easily performed, with fewer post-operative complications, such as bleeding, tears in Descemet's membrane, and iridodialysis.

SUMMARY

Inverse cyclodialysis is the method advocated by Blaskovics of effecting a dialysis by sweeping the Elschnig spatula from the suprachoroidal space into the anterior chamber. Its use, together with air injection, seems to offer a safer and more successful procedure in all cases requiring cyclodialysis. It is of particular value in glaucoma secondary to cataract surgery. Gonioscopic control of the site of operation is essential, if blood vessels and synechiae in the angle, which needlessly add to the complications, are to be avoided. The author's modifications of the original technique are given in detail. A statistical summary of 21 cases is included.

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THE RELATIVE VALUE OF SEVERAL DIAGNOSTIC TESTS FOR CHRONIC SIMPLE GLAUCOMA*

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New York

The diagnosis of chronic simple glaucoma is established without difficulty when, in a quiet eye, the intraocular pressure is found to be above the normal range, or when advanced signs of glaucoma are present, such as marked excavation of the nerve head, or typical field changes. In such eyes, the course of the disease has usually advanced sufficiently to reveal its presence by the irreversible changes it inevitably produces if uncontrolled. There are, however, patients who consult the ophthalmologist because of ocular symptoms that suggest the presence of chronic simple glaucoma, but who have normal ocular tensions even on repeated examinations. Such patients may show either no functional or anatomic signs of glaucoma, or insufficient evidence for such a diagnosis to be made. The diagnostic challenge such patients present is important, since the absence of definite evidence of chronic simple glaucoma does not eliminate the possibility of that disease being present in a mild or early stage. At such a time proper diagnosis and treatment are urgently necessary to prevent the insidious development of more advanced ocular damage.

Because of the frequent difficulty in detecting early chronic simple glaucoma, many diagnostic procedures have been devised. Since the purpose of these methods generally is to demonstrate the presence of the disease by producing an abnormal increase in the tension of the affected eye, they are often referred to as provocative tests. Our purpose in this investigation

was to study the diagnostic value of several of the more commonly employed of these procedures, and to compare their efficacy with that of a new test recently devised. The older diagnostic methods investigated were the dark-room test,¹ the caffeine test,² the mydriatic test,³ the water-drinking test,⁴ and the record of the 24-hour ocular tension curve.⁵ The newer procedure studied was the so-called lability test recently described by Bloomfield and Lambert.⁶

The eyes to which these tests were applied had each been previously found to have an intraocular pressure of over 30 mm. Hg (Schiotz), on several occasions. Most of them presented some confirmatory stigmas of glaucoma, such as excavation of the disc and characteristic field changes. When present, such signs were usually early and of mild degree. Gonioscopic examination was not performed on these eyes since our purpose, essentially, was to apply these tests to an average series of eyes with early chronic simple glaucoma, rather than to differentiate the results according to angle depths. At no time had evidence of intraocular inflammation been present in any of these eyes, and the diagnosis of chronic simple glaucoma seemed certain in each case. Eyes that had apparently suffered only acute congestive episodes were not included in this series. None of the eyes studied had undergone any operation, and the tension of each was apparently controlled by the instillation of pilocarpine.

For the purpose of our investigation, the medication of a group of such eyes with known chronic simple glaucoma was discontinued under observation. If the ocular tension rose above normal in any.

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eye, the administration of miotics was re-instituted and the patient excluded from this study. However, in many eyes the intraocular pressure remained within normal range, that is, below 30 mm. Hg (Schiotz), for 24 hours without medication. These eyes were tested, during such an interval of normal tension, with one or more of the diagnostic procedures under investigation. In this way, each experiment simulated the clinical problem of a patient who presents himself with normal ocular tension, but whose history suggests the possible presence of chronic simple glaucoma. This, of course, is the circumstance under which these tests are usually employed. Since each of the eyes in this study had previously shown definite evidence of the disease, the diagnostic value of each of these tests could be evaluated statistically from the number of positive results that occurred in this series. In other words, an ideal test would be positive in 100 percent of these cases.

In reviewing the literature on these diagnostic procedures, it was frequently found that the difference between the normal and abnormal responses to many of these tests was not clearly defined. For the purpose of this investigation it was, therefore, necessary to derive quantitative limits of normality from certain standard textbooks, when such criteria were not presented in the original descriptions of the tests. This seemed proper since these are the tonometric standards most commonly employed by ophthalmologists in the clinical performance of these procedures. For certain of the tests no definite standards whatever were found, and in such cases it was decided that rises in tension must exceed 6 mm. Hg (Schiotz), to be considered abnormal. It seemed questionable whether lesser elevations could be considered of definite diagnostic significance, in view of the limited accuracy of tonometry.⁷ Throughout this

investigation, ocular tensions were measured with the Schiotz tonometer, and recorded in millimeters of mercury in accordance with the chart accompanying that instrument. All the tonometric results that are numerically expressed in the description of the tests that follow, refer to that scale of measurement.

The dark-room test devised by Seidel¹ is performed by measuring the tension of the eye suspected of glaucoma before and immediately after the patient had been seated in a completely dark room for one hour. The occurrence, during this period, of an appreciable rise in tension is usually considered indicative of the presence of chronic simple glaucoma. According to Duke-Elder⁸ such a rise must be more than 6 mm. Hg (Schiotz), in order to be considered of diagnostic significance. In our experiments, 29 eyes in 22 patients, with a definite history of chronic simple glaucoma but with normal tension at the time of our study, were subjected to this test. In five of these eyes, or 17 percent, a rise in tension of more than 6 mm. occurred, to demonstrate the presence of that disease. In the remaining 24 of these eyes, lesser rises occurred to give misleading normal results. During this test, in six of the eyes in this series, or 21 percent, the tension rose over the level of 30 mm., which is usually considered the upper limit of the normal range of tension.⁹ The effect of the dark-room test on each eye is recorded in Figure 1.

The caffeine test² was performed by having each patient tested drink two large cups of dark black coffee in quick succession. The tension of each eye was measured before the drink was imbibed and thereafter at 15 minute intervals for one hour. According to Duke-Elder,⁸ in glaucomatous eyes a rise in tension should occur that may be 15 to 20 mm. Hg (Schiotz). No actual numerical standard for the normal limit of response to this

test could be found by us in the literature. For the reason previously mentioned it was decided that any rise in tension of more than 6 mm. was abnormal. Eighteen eyes in 13 patients with known chronic simple glaucoma were subjected to this caffeine test. Of these, only one eye, or 6 percent, showed a rise in tension of more than 6 mm. Lesser rises were recorded in six other eyes as shown in Figure 2, which demonstrates the effect of this test on all the eyes in this series. As is indicated, in no eye was the tension elevated above the normal limit of 30 mm. after the ingestion of the caffeine.

The diagnostic value of the mydriatic test³ was studied by the instillation into the eye of one drop of a 1-percent solution of paredrine three times at 10-minute in-

the highest tension recorded and that present before the mydriatic was administered was considered the diagnostic determinant. Homatropine was not employed

CAFFEINE TEST

INTRAOCULAR
TENSION IN MM.
OF MERCURY (SCHIØTZ).

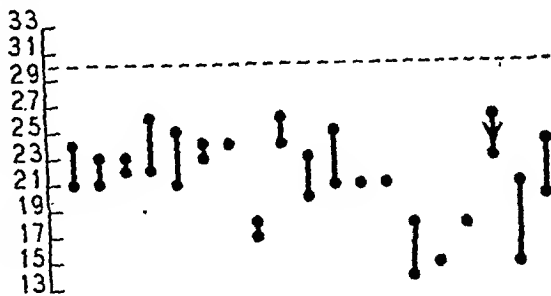


Fig. 2. (Bloomfield and Kellerman). Effect of the caffeine test. Each vertical line represents the change in tension of a single eye with chronic simple glaucoma after the drinking of two cups of strong black coffee. The arrow indicates a drop of tension.

DARK-ROOM TEST

INTRAOCULAR
TENSION IN MM.
OF MERCURY (SCHIØTZ)

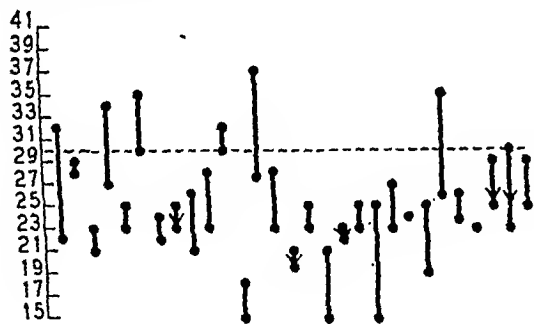


Fig. 1. (Bloomfield and Kellerman). Response to the dark-room test of eyes with chronic simple glaucoma but with normal tension at the time of the test. Each vertical line shows the tension response of a single eye. The lower dot indicates the initial ocular tension and the upper one the height or ceiling to which tension rose. The actual rise in each eye is, therefore, represented by the length of each line. The downward pointing arrow indicates those eyes in which a drop in tension occurred during the period of the test.

tervals. The tension of each eye was measured before the first drop was instilled, and then at half-hour intervals for three hours thereafter. The difference between

in this investigation since its intense and prolonged action occasionally precipitates acute congestive glaucoma; a condition less likely to be caused by paredrine. Furthermore, Kronfeld, McGarry, and Smith¹⁰ have demonstrated that mydriasis due to homatropine is often not effective in raising the tension of eyes with chronic simple glaucoma of the so-called "wide-angle" variety. Euphthalmine, with which this test had usually been performed previously, was not available because of wartime conditions. According to Duke-Elder,³ Gradle,¹¹ and others, no rise in intraocular pressure should be produced by mydriasis in a normal eye, and a measurable increase should be present in eyes with chronic simple glaucoma. Since no quantitative limit to the normal tension response to mydriasis could be found in the literature, we considered any rise in tension of more than 6 mm. to be an abnormal response to this test. Fifteen eyes with chronic simple glaucoma but normal

tensions at the time of our study were tested with mydriasis produced by paredrine, as described. In not one of these eyes did a rise in tension of 6 mm. or more occur. Lesser rises that occurred in 6 of these 15 eyes are indicated in Figure 3, which shows the effect of this test on all the eyes in this series. The dilatation of

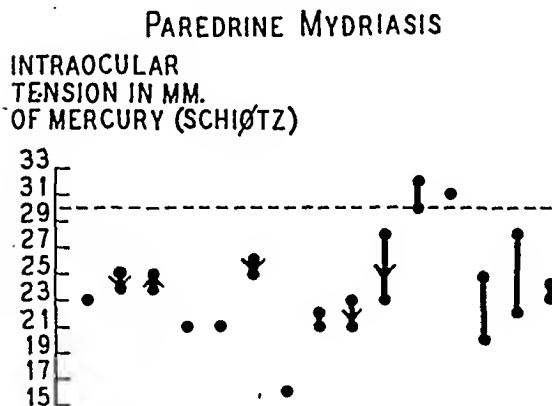


Fig. 3. (Bloomfield and Kellerman). Tension response of eyes with chronic simple glaucoma to mydriasis induced by paredrine.

the pupil that occurred in these eyes varied in degree from moderate to marked. Such tension elevations as were noted did not seem proportionate to the degree of mydriasis present. In only one eye in this group was the tension elevated above the normal limit of 30 mm.

The water-drinking test developed by Marx and applied to the eye by Schmidt⁴ was performed by having each patient whose eyes were to be studied, drink a quart of water rapidly, before breakfast. The tension of each eye was measured before the water was drunk, and again at 15-minute intervals for one hour. According to standard descriptions of this test,⁸ the tension of eyes with chronic simple glaucoma should rise more than 6 mm. Hg (Schiøtz) during this period. In this way, we tested 22 eyes with chronic simple glaucoma in 12 patients. In 18 of these eyes, or 82 percent, an abnormal rise in tension of more than 6 mm. occurred. In the remaining four eyes, lesser rises

were noted. In 17 eyes, or 77 percent, the tension was elevated over the level of 30 mm. The actual tonometric results recorded are presented in Figure 4.

Diurnal variations in intraocular pressure have been shown by Kollner,⁵ Hagen,¹² Sallmann and Deutsch,¹³ and others to be abnormally large in eyes with chronic simple glaucoma. A difference of over 10 mm. Hg (Schiøtz), between the highest and lowest tonometric readings over the period of study has been suggested to be abnormal by Kollner,⁵ Cordes,¹⁴ and Duke-Elder.⁸ For our investigation, 12 patients were hospitalized, all medication was discontinued, and the tensions of 20 eyes with chronic simple glaucoma were recorded every 4 hours for a consecutive period of 24 hours. In six eyes in this series or 30 percent, an abnormal fluctuation of more than 10 mm. occurred. In each of the others, lesser variations in tension were noted. The

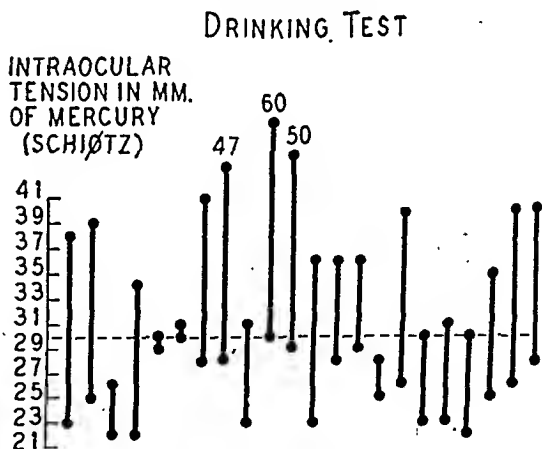


Fig. 4. (Bloomfield and Kellerman). Effect of the water-drinking test on eyes with chronic simple glaucoma.

actual differences between the highest and lowest tonometric reading for each eye during the 24-hour period of observation is presented in Figure 5. In nine eyes, or 45 percent of this group, a rise of tension to a level over 30 mm. was noted during the period of observation.

The lability test devised by Bloomfield and Lambert⁶ is a method for measuring the ability of the eye to maintain a relatively stable tension in the presence of sudden transient intraocular hyperemia. The procedure they described is, basically, the simultaneous application of the cold pressor test of Hines and Brown,¹⁵ and the jugular compression test described by Schoenberg.¹⁶

Bloomfield and Lambert⁶ demonstrated that neither of these two procedures alone produced diagnostically significant effects on eyes with chronic simple glaucoma. However, the combination of the two in the lability test proved to be more informative.

The lability test is performed by first measuring the tension of each eye to be tested. A blood-pressure cuff is placed loosely about the patient's neck. The patient then places the open hand in a basin of ice water up to the wrist. Simultaneously, the blood-pressure cuff is inflated to a pressure of 50 to 60 mm. Hg, as read on the attached sphygmomanometer scale. At the end of exactly one minute, the ocular tension is again recorded with the hand still in the ice water, and the cervical pressure undiminished. Thereupon, the hand is withdrawn, the pressure cuff removed, and the test is over, unless a repetition is desired for purposes of accuracy. The tension in all cases returns to its original level immediately.

At this hospital, this procedure has been performed on over 300 patients without serious complaint or undue discomfort. Old patients and hypertensive patients have been subjected to it without a single complication. The test is easily and quickly performed and only a few technical points must be remembered. One is that the water must be ice cold; for that purpose chipped ice is usually placed in the water about a quarter of an hour before use. It is also necessary that the bladder in the

pressure cuff be applied anteriorly on the neck so that both jugular veins are compressed simultaneously without protection from surrounding structures. Furthermore, the pressure must be maintained at just below 60 mm. Hg until after the tension is recorded, which should be after precisely one minute. The patient can

24 HOUR CURVES

INTRAOCULAR
TENSION IN MM.
OF MERCURY (SCHIÖTZ)

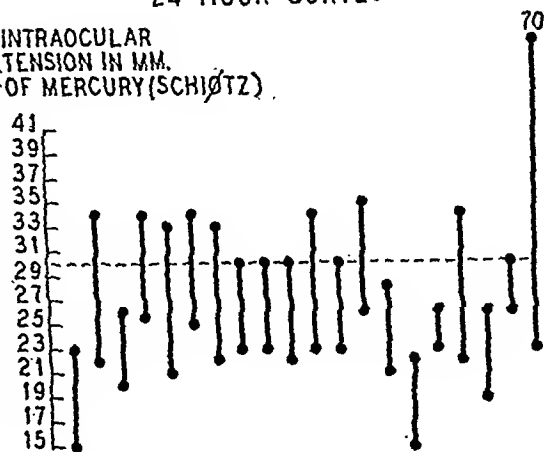


Fig. 5: (Bloomfield and Kellerman). Tension variation, during 24 hours, of eyes with chronic simple glaucoma. The lower dot represents the lowest tonometric reading during this period, and the upper one shows the highest reading. The length of each vertical line, therefore, indicates the amount of variation in tension that occurred in each of these eyes.—

breathe quite easily with such pressure about the neck, and, of course, at such levels, arterial circulation is unimpeded. Although some reddening of the face occurs, no real discomfort is experienced by the patient.

In the original description of this lability test,⁶ it was shown that if, in any eye, this procedure produced a rise in ocular tension of more than 9 mm. Hg (Schiotz), the diagnosis of chronic simple glaucoma was strongly suggested. However, if the height or ceiling to which the ocular tension rose exceeded the normal limit of 30 mm. whether or not the actual rise exceeded 9 mm., such a diagnosis was even more conclusively indicated. On the basis of these standards, in only 1 of

77 nonglaucomatous eyes was a distinctly abnormal result recorded by this test; while in almost every eye with chronic simple glaucoma that was tested at that time positive responses were obtained. These diagnostically significant responses resulted from tests applied only to eyes with chronic simple glaucoma. There is

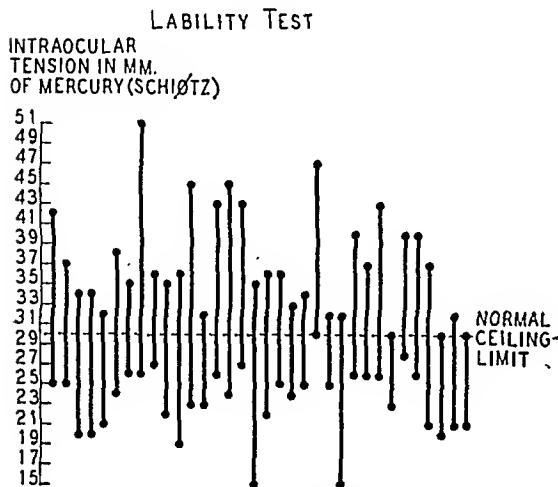


Fig. 6. (Bloomfield and Kellerman). Tension response induced by the lability test when applied to eyes with chronic simple glaucoma.

some evidence to suggest that eyes that have suffered acute congestive glaucoma may not display an abnormal lability of ocular tension by this method when they have recovered from an attack and are in a quiescent phase.¹⁷

To determine further the diagnostic value of the lability test, it was applied in our investigation to a series of 34 eyes in 24 patients with definite histories of chronic simple glaucoma, but with normal tensions at the time of our experiment, exactly as had been done in the study of the other diagnostic procedures. In 31 of these eyes, or 91 percent, rises in tension occurred that were 9 mm. or more. When the height or ceiling to which the tension rose in each eye was employed as a standard of response, as is preferred, it was found again that in 31 of these 34 eyes, or 91 percent it had risen above the normal limit of 30 mm. In the case of the other

three eyes in this group, the ceiling or height of tension reached was exactly 30 mm. which would be considered suggestive but not definitely indicative of the presence of chronic simple glaucoma. All these results are shown in Figure 6 in which the actual rise in tension and the ceiling reached in each eye is indicated. In no performance of the lability test in this series was undue discomfort or any complication noted.

Two or more of these six diagnostic procedures were applied to many of these eyes. This afforded the opportunity to compare directly the diagnostic efficacy of these tests when applied to the same glaucomatous eye with normal tension. In Figures 7 and 8 are shown the rises in tension that occurred when three or more tests were applied at different times to each of 24 eyes. It is apparent that in a large majority of these eyes, the lability and water-drinking tests produced a markedly greater rise in tension than did any of the other diagnostic procedures. This observation indicates that in addition to their greater diagnostic reliability as previously demonstrated, these tests produce an abnormal response in eyes with chronic simple glaucoma that is usually more distinctly appreciable than that of the other tests studied.

COMMENT

In evaluating a diagnostic test, the primary consideration is its reliability in demonstrating the presence of the disease for which it was devised. Secondary considerations affecting the practical value of any test are its simplicity of interpretation and its ease of performance.

A prime necessity for a dependable test is, of course, the establishment of reliable criteria to differentiate normal responses from abnormal ones. It was not the purpose of this study to determine such standards for any of these tests, but rather

INTRAOCULAR
TENSION IN MM.
OF MERCURY (SCHIÖTZ)

---- Lability Test
— Water Drinking Test
--- 24 Hour Curve
..... Dark Room Test
***** Caffeine Test
xxxxx Paredrine Mydriasis

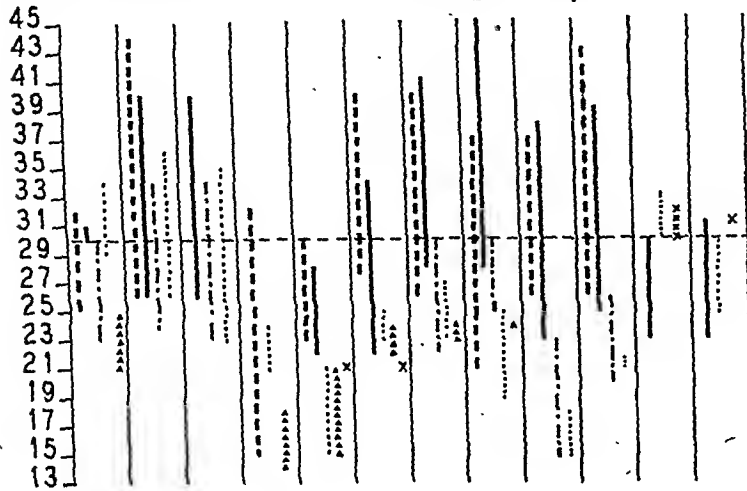


Fig. 7. (Bloomfield and Kellerman). Graphic presentation of the effect of various tests when applied to the same eyes. Each compartment represents one eye and the tension rises shown were produced in that eye by the different tests as indicated in the accompanying legend. As in the previous figures, the bottom of each vertical line is the initial tension and the top of the line indicates the height to which the tension rose in response to that particular test.

INTRAOCULAR
TENSION IN MM.
OF MERCURY (SCHIÖTZ)

---- Lability Test
— Water Drinking Test
--- 24 Hour Curve
..... Dark Room Test
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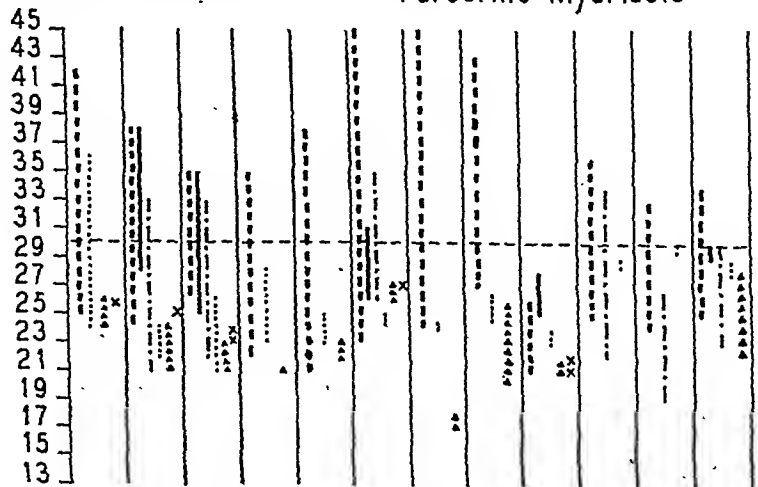


Fig. 8. (Bloomfield and Kellerman). Continuation of Figure 7, further demonstrating the effects of different tests on individual eyes with chronic simple glaucoma.

to ascertain the reliability of these different procedures, using the standards most often employed in their clinical application. The poor results obtained in certain of these tests, therefore, may be due to the common use of faulty criteria in their

interpretation rather than to the actual unworthiness of the procedures themselves. In any case, however, it is important to be aware of the misleading information that such tests may yield, in their present form.

It may be noted that the results of provocative tests are generally interpreted according to the rise in tension that they produce in any eye. To explore the possibility of applying a single standard to all of them, the actual height or ceiling to which the tension rose in these eyes during each test was noted. Since 30 mm. Hg (Schjøtz) is generally accepted as the upper limit of normal intraocular pressure,⁹ any elevation in tension above this level, no matter how produced, might be considered indicative of glaucoma. This concept of a normal ceiling for variations in a homeostatic system was described by Hines and Bröwn¹⁵ in their elucidation of the cold-pressor test for essential hypertension, and was adopted by Bloomfield and Lambert⁶ as a standard for the lability test. As is shown in the charts for each test studied here, the eyes in which abnormally high rises in tension occurred were usually, although not always, the ones in which intraocular pressure was elevated to abnormal levels; that is, over 30 mm. Hg (Schjøtz). Of even greater interest is the fact that the number of positive results obtained with each of these tests on these glaucomatous eyes was approximately the same whether the standard of abnormality was the span of fluctuation in tension that occurred, or the elevated level of tension or ceiling reached in each case. In other words, the reliability of each of these tests appears to be approximately the same no matter which of these two criteria is employed in its interpretation.

Our investigation has shown that the so-called lability test whose effect is produced by the induction of a transient intraocular hyperemia is the most reliable of the diagnostic procedures studied: It should be pointed out that this result applies only to eyes with chronic simple glaucoma, since no eye was studied that had either secondary glaucoma or recur-

rent episodes of acute congestive glaucoma followed by periods of apparently normal tension. The water-drinking test proved to be almost as trustworthy as the lability test. The 24-hour study of ocular-tension variations proved of decidedly less diagnostic value in these eyes with known chronic simple glaucoma. This suggests either that the 24-hour curve of tension variations is not as reliable an indicator of the disease as is usually supposed, or that the standards usually employed for its evaluation are at fault. The dark-room test proved to be of questionable diagnostic value. The response to the caffeine test and to the mydriasis produced by paredrine indicated that no diagnostic significance could be attached to these two procedures.

Another important consideration in evaluating the diagnostic worth of any clinical procedure is the ease of interpretation of its results. It is obvious that however consistently a test might produce rises in tension in eyes with chronic simple glaucoma, if such increases were often so small as to be attributable to the limited accuracy of tonometry, they might frequently be overlooked and the results of the test incorrectly evaluated. It was for this reason that in studying these procedures an elevation of at least 6 mm. of Hg (Schjøtz) was postulated as necessary for positive diagnostic significance, and that a greater rise was considered even more desirable. In Figures 7 and 8, it is demonstrated that the elevations in tension produced by the lability test, and by the water-drinking test to a lesser degree, are generally significantly greater than those produced by the other procedures considered.

Of lesser importance, but worthy of consideration, is the ease of performance of each of these tests. The lability test requires no unusual apparatus, and is by far the quickest, since it can be performed

in a little over one minute. This speed of performance permits a repetition of the test in a relatively short period, if desired, for purposes of accuracy. The other diagnostic procedures here considered all require much longer periods of time for their performance, as described. The water-drinking test, which is the only one that approaches the lability test in reliability and degree of response evoked, requires that the patient be tested before breakfast, and that tonometric readings be taken for one hour. The inconvenience of such a procedure emphasizes the general superiority of the lability test as a diagnostic method for the early detection of chronic simple glaucoma.

SUMMARY

Six tests commonly employed for the diagnosis of chronic simple glaucoma were

applied to a series of eyes with that disease but with normal tension, at the time of this study, although medication had been interrupted.

The presence of chronic simple glaucoma was demonstrated in these eyes most consistently by the lability test of Bloomfield and Lambert, closely followed in reliability by the water-drinking test.

In decreasing order the diurnal tension curve, the dark-room test, the caffeine test, and the response to mydriasis induced by paredrine, proved much less dependable.

The lability test also produced the most appreciable tension responses in these eyes, and seemed the quickest and most convenient procedure to perform.

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LIPIODOL STUDIES OF CHRONIC DACRYOCYSTITIS

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Functionally the lacrimal drainage system is an elaborate mechanism. Normal tear conduction depends on: (1) lids with their mucous glands that are normal in position and function; (2) atmospheric pressure and humidity for partial evaporation of tears; (3) massage action of the orbicularis; (4) capillarity to draw tears from the lacus lacrimalis into the canaliculi; (5) vacuum-created suction to carry tears into the sac; (6) gravity to draw tears into the inferior nasal meatus, and so forth.

Anatomically, normal tear conduction depends on the integrity of a potential channel of almost microscopic caliber possessing a number of sharp angulations. The anatomy of this system is familiar to all ophthalmologists and requires no elaboration, but it should be recalled here that, although the lacrimal sac and duct are potential cavities, actually they are mere slits whose lumina merge imperceptibly both anatomically and histologically. There is not much difference in the size of the two lumina, so that they comprise one continuous functioning tube—normally. However, this tube is lined with a delicate mucosa which is constantly exposed to infection to which it all too frequently succumbs. The lower end of this tube, the nasal duct, is especially vulnerable and likely to upset the whole delicate drainage mechanism. This has been known for a long time. For while contraction and malposition of the puncta, stricture and obstruction of the canaliculi, descending infections from the conjunctival sac, and many other factors may play a part, by far the most commonly cited cause of chronic dacryocystitis in the adult is an ascending infection from the nose.

Fuchs¹ states: "The immediate cause of

a chronic dacryocystitis is stricture of the nasal duct. . . . The constriction . . . develops, as a rule, in consequence of affections of the nasal cavity." De Schweinitz² says: "In the majority of cases, blennorrhea of the sac is caused by a retention of the secretion on account of stricture or obstruction in the nasal duct, and the participation of the lining of the sac in an inflammation of the nasopharynx." Parsons,³ while not so overwhelming in his indictment, also states that: "Chronic dacryocystitis is commonly attributed to the effects of stricture of the nasal duct. . . . Obstruction to the lower end of the nasal duct may be caused by the pressure of nasal polypi, an hypertrophied inferior nasal turbinate bone, extreme deviation of the septum, and so on." Collins and Mayo⁴ state unequivocally that: "Inflammation of the lacrimal sac (dacryocystitis) is always accompanied by obstruction of the duct. . . . The common causes of lacrimal obstruction. . . . are . . . in adults, —inflammatory affections of the mucous lining spreading from the nose."

In a recent comprehensive review of the whole subject Garfin⁵ comes to the conclusion that: "Dacryocystitis is contingent on stenosis of the nasolacrimal duct, either congenital or acquired, plus a secondary infection. The opinion of the majority of authors cited is that the etiological factor is usually to be found in the nose in the form of an acute or chronic inflammation or in disease of the sinuses. Trauma, physical or surgical, and infectious diseases of the nose may also play a part in the causation of dacryocystitis."

REPORT ON LIPIODOL STUDIES

The X-ray studies shown here are of interest because they present in graphic detail visible testimony of the effect of

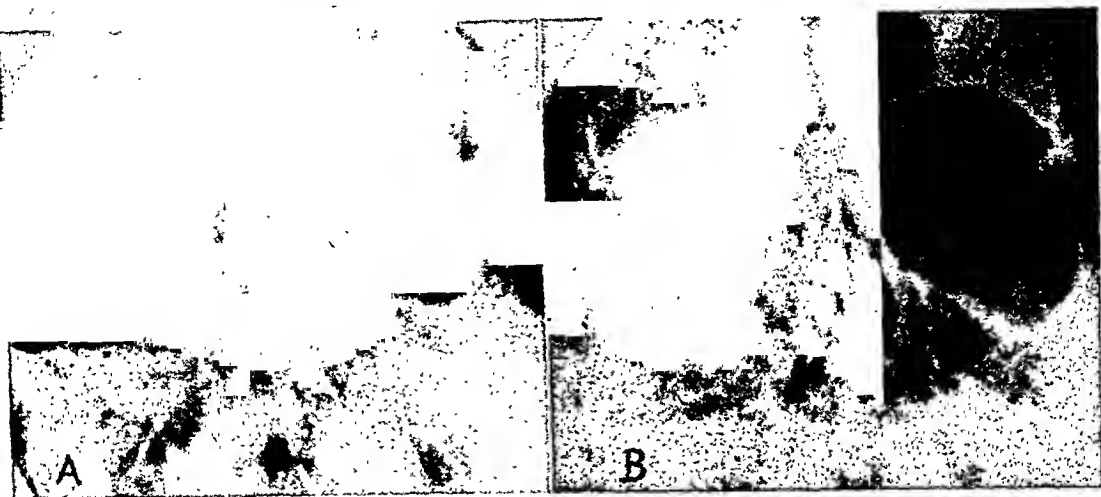


Fig. 1 (Fox). a, Early nontraumatic, chronic dacryocystitis before sac dilatation. b, Same case 16 months after dacryocystorhinostomy showing free passage of lipiodol into nose.

chronic inflammation and trauma on the nasolacrimal drainage channels. They were obtained by injecting the sacs in various types of chronic dacryocystitis with lipiodol before the X-ray studies were made. These photographs have been selected from a large series and are typical of the common findings.

TECHNIQUE

The technique of lipiodol injection into the lacrimal sac is simplicity itself. An ampule of lipiodol is placed in warm water for a few minutes. The sac to be injected is thoroughly irrigated and gently massaged to assure its emptiness. The lipiodol is drawn up into a small syringe and injected through a lacrimal needle into the sac in the usual manner of sac irrigation until the lipiodol is seen to flow back into the conjunctival sac. Excess lipiodol is then wiped out of the conjunctival sac and X-ray plates, a-p and lateral, are taken within a half hour of injection.

In order to simplify presentation and discussion the cases have been divided into three groups.

NONSPECIFIC CHRONIC DACRYOCYSTITIS

Figures 1 and 2 are typical cases of the nonspecific type of chronic dacryocystitis

commonly seen by ophthalmologists. The sac in Figure 1a and the smaller sac in Figure 2 are early cases before distention has occurred. Both are good illustrations of an approximately normal sized sac soon after obstruction has occurred. The larger sac in Figure 2, on the other hand, is a six-months-old case in which a mucocele is already present. Figure 2 is interesting because it shows a bilateral case, the mucocele being the result of a persisting chronic inflammation, while the smaller sac has been obstructed for only 21 days. It shows strikingly what a lasting



Fig. 2 (Fox). Bilateral, chronic dacryocystitis. Larger sac has been involved for six months; smaller sac for only three weeks.



Fig. 3 (Fox). a, Traumatic dacryocystitis with huge mucocoele nine months after bullet wound of left orbit with point of exit behind left ear. b, Same in lateral view showing forward bulging and dilatation. c, Same following dacryocystorhinostomy (negative has been reversed). There was no direct trauma to the sac.

inflammation does to the nasal sac.

Note that in all three sacs the obstruction starts at the upper end of the duct and that all three are narrower above near the dome and wider below. This is typical.

TRAUMATIC CHRONIC DACRYOCYSTITIS WITH INTACT SAC

Among recent war casualties, many cases of chronic dacryocystitis were seen which were the result of trauma to the eyes and other tissues surrounding the lacrimal sac and duct. This included trauma to the inner half of the lids, especially the lower punctum, the nose, the ipsilateral sinuses, the jaw, and the lacri-

mal passages themselves; in other words, any type of trauma to the lacrimal passages or the adjacent tissues which would interfere with normal tear conduction and lead to lacrimal stasis and its ensuing syndrome.

Despite the difference in initiating etiology the sacs in Figures 3, 4a, and 5 all show mucocoele formation not unlike that seen in Figure 2 and the reason for this is that the sac always reacts to obstruction in the same way. In such cases the inflammation and infection are usually consequent to stasis and not the causative factor, but the intact sac behaves similarly in both conditions and gives the same ul-

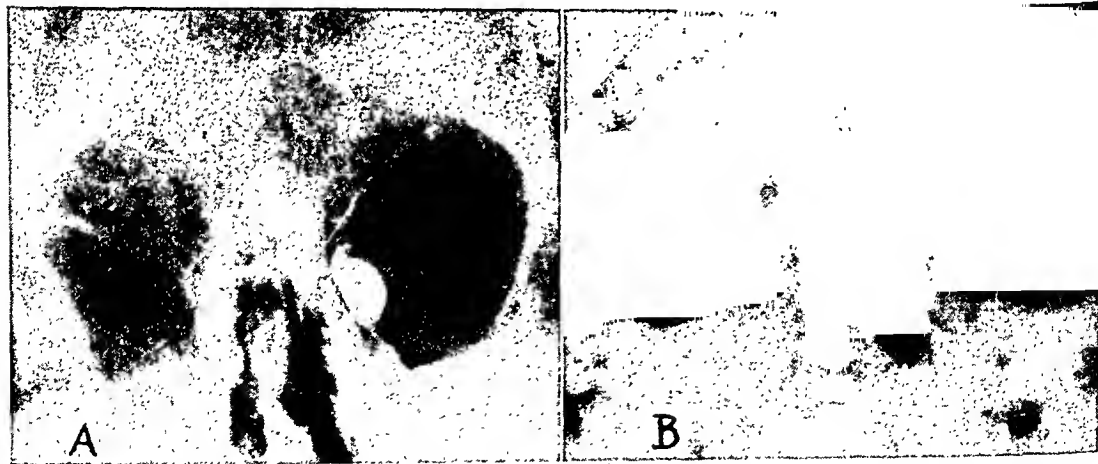


Fig. 4 (Fox). Bilateral, traumatic, chronic dacryocystitis seven months after injury by bullet which entered the left angle of the jaw and came out through the right orbit causing fractures of the facial bones and both orbits. a, Mucocoele of intact sac indistinguishable from that of the non-traumatic type. b, Small sac with absent dome due to direct injury and consequent strictures. Bony destruction was so severe that rhinostomy was impossible and bilateral cystectomy was performed.

timate clinical picture; that is, obstruction of the duct end, dilatation, and final mucocele formation (figs. 2 and 4a).

TRAUMATIC CHRONIC DACRYOCYSTITIS WITH SAC INVOLVEMENT

Where there has been trauma to the sac the X-ray picture is entirely different. Thus, Figures 4b, 6, 7, 8, and 9 show sacs radically different in outline from the others. The most striking differentiating feature is that all these sacs are *smaller* than normal (figs. 1a and 2). Furthermore, they are all misshapen, showing irregular outlines due to strictures in and around the sac and consequent reduction of contents. Figure 4 is an interesting case of bilateral traumatic chronic dacryocystitis, with Figure 4a showing an intact sac indistinguishable from the nonspecific type. The sac in Figure 4b, however, was *directly* involved in the same injury and shows it by reduction of the lumen and a missing dome. In Figure 6, the sac is not only small but is wider above. This is contrary to the usual picture seen in the untraumatized sac. Figure 7 shows a tiny



Fig. 6 (Fox). Traumatic, chronic dacryocystitis seven months after jeep accident in which the patient sustained fractures of the nasal bones and direct trauma to the sac. Note that the sac is small as compared with those shown in Figures 3, 4a, and 5, and that the upper part of the sac is wider than the lower portion. This is contrary to the usual picture in nontraumatic dacryocystitis.

residual functioning sac cavity into which lipiodol was injected with some difficulty. Figure 8 shows a similar sac only slightly larger. The functioning portion of both these sacs is below the canthal ligament, the dome being obliterated. Figure 9, on the other hand, shows only the upper portion of the sac to be functioning and even this is not free of adhesions, as may be seen. All these abnormal manifestations are due to adhesions in and adjacent to the sac. Also, here as in all other cases, the duct is not visible.

DISCUSSION

These X-ray findings seem to corroborate what has been previously known about the cause of chronic dacryocystitis and are compatible with our knowledge of the anatomy and physiology of the nasolacrimal drainage system. The nasolacrimal sac normally holds about 2 cc. of fluid, a capacity which is more than adequate for the transmission of the 0.3 to 0.5 cc. of tears normally secreted per day. Not only that, but the sac is quite elastic

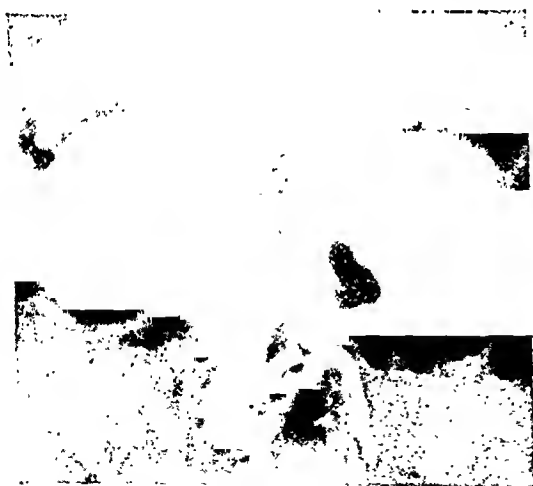


Fig. 5 (Fox). Traumatic, chronic dacryocystitis 9½ months after shell fragment wound involving both antra. Note distention and convolution of intact sac and its relation to lid edges outlined with lipiodol. Patency was maintained for a while as shown by the free passage of lipiodol into the nose. It was finally necessary to resort to surgery.



Fig. 7 (Fox). Traumatic, chronic dacryocystitis with sac involvement four months after shell-fragment injury of nose and antrum. Most of the sac lumen is obliterated with only a small part of the lower portion left patent as seen by relation to lid edges marked out with lipiodol. This was enough to give a purulent dacryocystitis and extirpation of the sac remnant was required preceding plastic surgery.

and, being covered anteriorly and laterally by yielding tissue, is easily distended by internal pressure to hold five times this amount, if necessary. This happens frequently as shown above. On the other hand, the nasal duct which is only about 15 mm. long runs in a bony canal formed by the maxilla, the lacrimal bone, and the lacrimal process of the inferior turbinate. This allows for but little, if any, distention.

Another anatomic fact noted by Wolff⁶ furnishes an additional reason for this being the common site of the obstruction. The sac itself slopes gently outward, while the duct inclines somewhat inward. Hence, at the point of junction there is a slight but definite angulation as well as constriction, and it is here that the obstruction usually occurs. In other words, this is the beginning of the narrow, indistensible portion of the channel and usually the highest point of obstruction. This has been corroborated by Halle⁷ and others. In addition, Schaeffer⁸ states that the lumen of the nasolacrimal duct is frequently irregular and tortuous and not in-

frequently shows outpouchings and diverticula, all predisposing to stasis and consequent stricture. Jacod,⁹ as well as others, has pointed out that the thinness of the wall between the lacrimal passages and an infected ethmoidal sinus makes the former quite vulnerable to such infection. Thus, given an ascending infection from the nose or sinuses with a consequent involvement of the nasolacrimal mucosa, the duct, having no room to distend, will soon become clogged up and strictures will rapidly develop. Even in the early cases shown in Figures 1a and 2, the duct is already closed. The sac, however, will be dilated with mucopurulent secretions from the infected mucosa and retained tears, the walls will become thickened, and the result will be the usual mucocoele of chronic dacryocystitis. This is why probing, unless done very early, is so rarely successful.

When the sac has suffered no trauma, it will always be found to be narrower at the dome and wider below (figs. 1, 2, and 4a). The reason is this: Although the chronically infected sac is closed at both ends, the upper fundus portion is covered by the internal canthal ligament which is



Fig. 8 (Fox). Traumatic, chronic dacryocystitis with sac involvement 14 months after injury to bridge of nose. Note the irregularity of the sac outline and absence of the dome, as compared with Figures 1 and 2.

a tough inelastic fibrous tissue allowing for but little distention. The portion of the sac below the internal canthal ligament, however, is covered only by a few fibers of the orbicularis and this area is the first to distend because there is little resistance here. This is also why most of the abscesses and fistulas of the sac break through at this point. A possible subsidiary cause may be the fact that the upper part of the sac has an outlet

pending only on where the trauma is. It has been shown above that in such cases the sac is always smaller than normal and irregular in outline. In fact, the sac lumen may be so reduced as to be almost absent (fig. 7). Despite this, even these cases develop a chronic dacryocystitis, which has to be reckoned with if surgery of the neighboring tissues is contemplated. For, as long as there is any uninjured mucosa left and as long as the con-

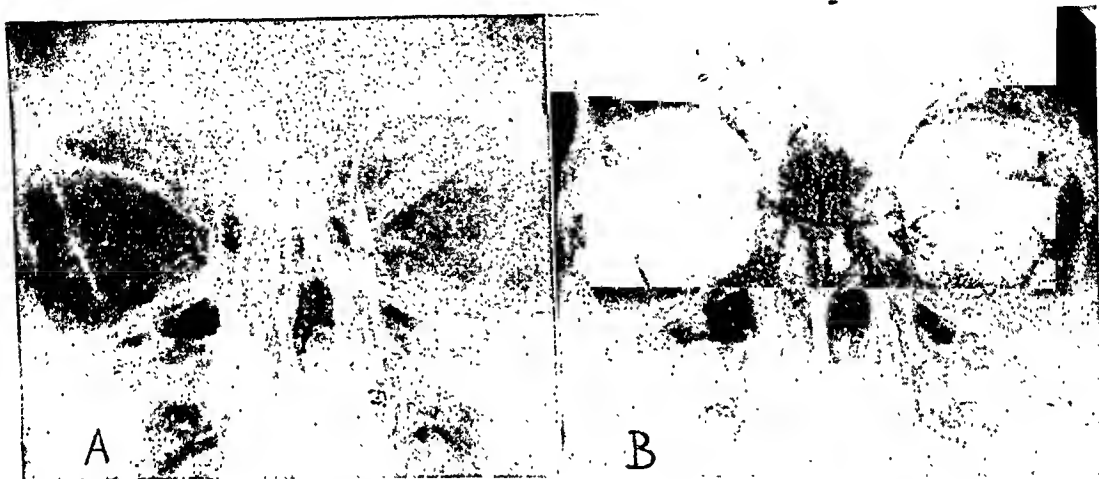


Fig. 9 (Fox). a, Traumatic, chronic dacryocystitis following injury to nose 25 months previously. The small amount of lipiodol retained and the absence of the lower half of the sac are due to strictures. Note the normal relation of the canaliculi to the sac as outlined by the lipiodol. b, Patency of the lacrimal channel following dacryocystorhinostomy.

through the canaliculi into the conjunctival sac, and the pressure at the dome is thus relieved. However, this is probably a negligible factor.

It will also be seen that, in all these cases where the sac is intact, the dilatation is forward and not backward, note especially Figure 3b, because of the unyielding posterior bony wall. Sometimes the sac becomes so dilated as to show convolutions. Figure 5 shows such a case in which partial atresia was relieved for a while by probing. Finally, however, surgery was necessary to relieve the obstruction.

When there has been direct trauma to the sac or the closely adjoining tissues, all types of bizarre pictures are possible, de-

nection through the canaliculi remains patent, pus is formed and finds its way into the conjunctival sac. Even in these cases, if there is not too much bony destruction, dacryocystorhinostomy is sometimes worth trying. Figure 9b shows the successful result following operation on such a sac.

The value of X-ray studies of the lipiodol-filled sac in all cases of chronic dacryocystitis is obvious. It not only helps the ophthalmologist to diagnose the type of case with which he is dealing and to ascertain the point of obstruction, but it also shows him what he will find when surgery is carried out. Even better, it will help him to decide whether or not surgery should be undertaken. (In cases such as

shown in Figure 7, for instance, one would hesitate to undertake a dacryocystorhinostomy.) This is a diagnostic procedure which should be used in all cases of chronic dacryocystitis.

There is no intention here to go into detailed discussion of the therapy of chronic dacryocystitis. Early cases without permanent stricture may respond to irrigation and medication or even probing. In cases of long standing, all these measures will usually be unsuccessful. The X-ray studies presented here show that, unless a sac has sustained trauma, it is usually dilated and needs no probing. The duct runs in such a narrow channel and fibrous tissue is laid down so early that probing is usually a painful, useless procedure.

At various times successful results have been reported with the use of setons, cannulae, and grafts of various sorts. The dacryocystorhinostomy, however, seems to have received the widest acceptance from ophthalmologists and it seems to offer the best prognosis for a cure. This point is stressed because it has been stated¹⁰ that, with complete atony of the sac, tears will not be carried into the nose even if the duct becomes pervious. The lipiodol studies shown here prove that any case of chronic dacryocystitis which has lasted for any length of time develops a dilated and frequently atonic sac. Despite

this rhinostomy is successful in the majority of uncomplicated cases.

CONCLUSIONS

Most authorities agree that the common cause of nonspecific chronic dacryocystitis is an ascending infection from the nose or paranasal sinuses causing obstruction of the lacrimal duct. The X-ray studies reported here tend to confirm this.

The lacrimal sac in these cases becomes dilated and atonic when the infection is persistent. The dilatation is always forward and greater below the internal canthal ligament. The sac may become so dilated as to show convolutions.

The same characteristic X-ray picture is seen in cases of chronic dacryocystitis where the sac has become obstructed due to trauma to neighboring tissues but is itself intact.

When the sac is traumatically involved, it is always smaller than normal and irregular in outline. Here also the duct is always obstructed.

An X-ray study of the lipiodol-injected sac is a valuable diagnostic procedure and is of special importance when surgery is contemplated.

I am indebted to Dr. Jacob Reber for his invaluable assistance in this work.

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FACTORS IN THE DIAGNOSIS OF ANISEIKONIA AND PAIRED MADDOX-ROD TESTS*

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There are 21 aniseikonia clinics in the United States. In our general population, as many as two-million persons may have complaints correctable by aniseikonic glasses,¹ which would otherwise remain unrelieved. This means that about five per cent of those wearing glasses would be benefited by aniseikonic correction.

It may be years before enough refractionists obtain the instruments and acquire the experience necessary to prescribe successfully for this condition. In the meantime, it is important for the refractionist to recognize which of his patients he should refer for aniseikonic study. Unfortunately, no simple screening device has been available, which will positively rule out aniseikonia. The following pages were written in the hope of promoting interest and understanding of some of the problems of handling aniseikonic patients, and to present what bases there are for diagnosis without the use of the standard instruments.

In lieu of aniseikonic correction, many refractionists today rely on altering the subjective monocular refractive prescription to relieve the complaints of patients with severe phoria, high anisometropia, or high astigmatism. Correction for aniseikonia in such patients, however, gives the higher acuity of full correction, with the comforts of stereopsis and high fusional amplitudes.²

IMPORTANCE OF BINOCULAR REFRACTION

Although the patient is to receive a screening and not a prescription test for aniseikonia, the refraction must be done with the utmost care. The aniseikonic pa-

tient is more critical, has high visual acuity in most cases, and not only notices slight changes in the prescription, but may complain bitterly.

There has been emphasis on "balancing the accommodative state" of the two eyes. This is a confusing phrase, because in all normal situations, the accommodation balances itself. Accommodative impulses wherever their origin are distributed equally so that both eyes accommodate equally and synchronously. It is better to say that the refractive lenses over the two eyes should be balanced so that the object and both retinal images are in conjugate focus at any given distance. This has been done by use of the stigmatoscopy refractive method,^{3,4} which has been in use for the past 20 years. All who have used it find it convenient and accurate. The device was present on the original ophthalmoeikonometers, and all of these instruments are still in use, in spite of subsequent "improved" models on which it was deleted for reasons of economy.

Two other methods of binocular refraction are in use: "Sensitometry," by Luckiesh and Moss, Cleveland;⁵ and the "Leland Polaroid Refractor" by Van Wien, Chicago.⁶ The "sensitometry" method is unusual because it uses, as a criterion of focus, not visual acuity but the brightness contrast threshold. This method is highly interesting and deserves more attention. The Leland polaroid refractor is an ingenious device which permits both eyes to see the test objects dimly with intermittent bright illumination visible only to the eye being tested. Both eyes maintain central, as well as peripheral, fixation and concomitant movement, ensuring binocular vision.

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In ordinary methods of refraction, errors occur due to poor control of binocular conditions. For instance, one will retinoscope a hyperope, add more and more plus until suddenly all the plus must be removed. This is not ciliary spasm. The patient is fixing a distant target with both eyes. When plus spheres are added to one eye, both eyes relax accommodation until the fixation target is blurred, when the other uncorrected eye takes over. This eye was in focus for infinity, and must accommodate sharply to focus on 20 feet. Since both eyes accommodate equally, the retinoscopist is surprised to find that he has added too much plus, and must start over.

The chief advantage of binocular non-cycloplegic refraction is that the test is done under normal working conditions, avoiding peripheral corneal and lenticular aberrations. The test need not be repeated to make sure the patient will consent to wear the prescribed lens combination. The accommodative level is adapted to convergence at all distances so that at no distance will one eye begin to blur. An eye which is less free to accommodate exactly on the fixation point is slightly blurred, and is inhibited in its fusional movements.⁷ If it happens to be the dominant eye, the patient may be seriously handicapped. In exophoria, a binocular refraction results in a prescription more minus for distance. In esophoria, the result is more plus for near. A nonpresbyopic patient with exophoria will find the full monocular correction blurs his vision for distance, due to excess accommodation from convergence stimulus.

It is important to fix the axes of high oblique astigmatism under binocular conditions, because of the high probability of cyclophoria in such patients. The astigmatic axis determined monocularly may be from 3 to 7 degrees different in each eye from that determined under binocular

conditions when the eyes both rotate from the position of rest to maintain fusion.

H. Culbertson, in 1888,⁸ would adjust the cylinder axes in oblique astigmatism binocularly until the appearance of slanting floors or leaning walls was corrected. G. C. Savage⁹ described methods of changing the axis of astigmatism derived monocularly to an axis which would relieve the strain on weak oblique muscles. Dr. Savage went so far as to prescribe weak oblique cylinders for this purpose in the absence of astigmatism.

This binocular adjustment of cylinder axes may be done with paired Maddox rods. Place a base-down prism over one eye in the phoropter or phorometer. Adjust both Maddox rods at exactly 90 degrees to produce two horizontal lines from one muscle light. If the lines appear horizontal and parallel to the patient, there is no cyclophoria. If not, one can gradually rotate one or both cylinders to make each line horizontal and parallel. In practice, this may require a greater axis change than seems reasonable.

A more conservative method is that suggested by the Leland-Van Wien technique. Blur the vision of one eye to 20/40 with a dark glass. The contours of the large letters and the chart edges will maintain concomitant rotations. Then test the cylinder axis on the unblurred eye in the usual way with the Jackson crossed cylinder on a line lower than is visible to the blurred eye. Check the binocular acuity to make sure the cylinder axes have not been changed too much.

CLINICAL FACTORS SUGGESTING ANISEIKONIA

Aniseikonia may be suspected in all patients not relieved by other means; or in patients with inadequate stereopsis. Aniseikonia is common in those corrected for anisometropia, oblique astigmatism, or high ametropia. Patients with phoria

and intermittent tropia may have aniseikonia. Aniseikonic patients are usually doing work of a type which makes critical demands upon binocular vision. In children and students, aniseikonic glasses are prescribed frequently for fusion or reading difficulties.

The most frequent complaint is headache following reading or near work. Patients may complain that long rides or the movies will produce eye strain, headache, vertigo, or nausea. Some have discovered that closure of one eye for certain tasks will reduce symptoms. Headache may be

the visual field is seen from slightly different points of view, can be appreciated physiologically. Changing the magnification of the image of one eye will change the relative differences between the images in the two eyes, and one would therefore expect a change in subjective localization of all objects in view. This is found to be true of objects whose configuration does not lend itself to monocular depth localization.

This binocular distortion can be demonstrated to one with normal eyes as follows: Place an afocal magnifier before

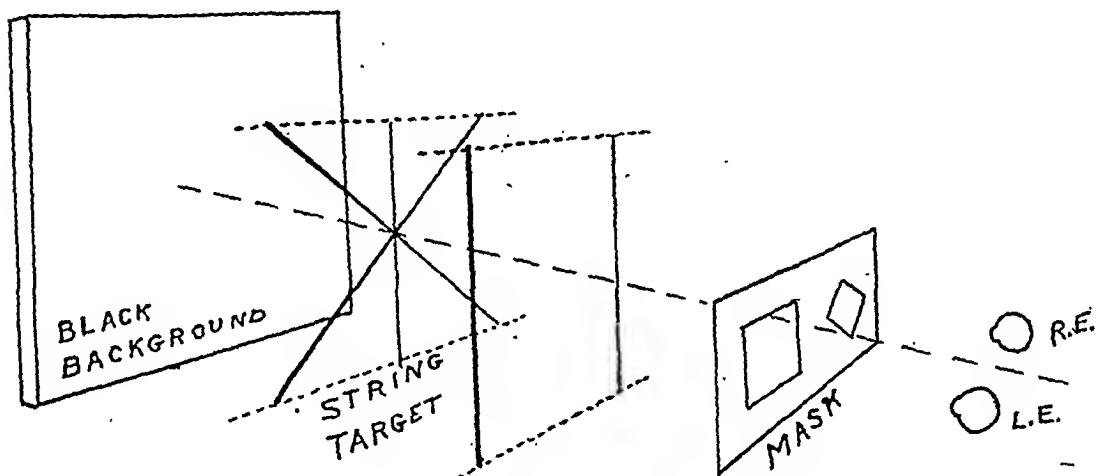


Fig. 1 (Miles). The space-eikonometer test for aniseikonia.

severe enough to be called migraine, and is commonly of many years' duration. There may be photophobia and asthenopia alone.

The patient with aniseikonia frequently does not know that his binocular space judgments are distorted. To detect such distortion, one must eliminate all monocular clues for depth localization such as known size, parallax, perspective, overlay, object movement, and so forth. This is effected in the space-eikonometer test for aniseikonia (fig. 1). Precision in this test is entirely from stereopsis, wherein the small differences between the retinal images of the two eyes which occur because

one eye consisting of trial-case lenses ($-5.00D.$ cyl. ax. 90° \ominus $+5.00D.$ cyl. ax. 90°) displaced about 1 cm. apart. Observe a person with his arms outstretched laterally, and note that one arm is several inches longer than the other. When his arms are stretched anteriorly, the other arm has become longer. At the same instant, any windows, furniture, or other background detail will appear perfectly normal and symmetrical. Evidently one is using monocular clues on the background at the same time one is using binocular clues on the person's arms. This must be selective suppression of parts of an image.

If a normal person were to wear this

lens combination over one eye for a few days, this distortion would become less evident for most ordinary views, because the conflict between monocular and binocular clues is easily won by the monocular. The patient with aniseikonia, according to theory, is unable to suppress properly, and will therefore develop eye strain. When the nervous mechanism controlling eye movements and accommodation is presented with two different sets of stimuli which differ considerably, the normal oscillation of accommodation and extraocular muscle tone is disturbed. Theoretically, this is a cause of phoria.

I was able to wear a 3-percent, axis 180° , aniseikonic lens over one eye for 4 weeks, then a 4-percent, axis 180° , lens over the other eye for 5 weeks without great discomfort. The initial distortion disappeared in 4 days. On wearing oblique aniseikonic glasses for 4 weeks: R.E., 2-percent, axis 45° ; L.E., 2-percent, axis 135° , I had constant, mild eye strain and more persistent distortion. It took much practice to relearn such a game as badminton, while wearing these lenses. Twice daily tests on the space eikonometer and on the ophthalmoeikonometer showed no tendency for an adaptive process.¹⁰

Monocular occlusion is valuable in the diagnosis and treatment of aniseikonia.¹¹ Unfortunately in some adult patients, occlusion is annoying, and is often not sufficiently complete, continuous, and prolonged to do any good.

One patient (D. E. S., a woman, aged 47 years) was given an opaque contact lens for one eye, and was comfortable for several months. A small perforation of the enamel admitted an unnoticed beam of light, leading to a difficult-to-explain recurrence of her complaint. When the perforation was finally found and covered, she again became comfortable.

Another patient (W. R., a man, aged 32 years) required less occlusion.

He had never been able to play tennis or baseball because of inability to follow a small moving object. A movie would give him such a headache that he would have to go to bed for 24 hours. He had had six refractions in 10 years without receiving wearable glasses. He found that a pair prescribed for his cousin did help him somewhat. He had moderate oblique bilateral astigmatism, which was corrected on one eye by the cousin's glasses and which, in addition, blurred the other eye to 20/70. He found aniseikonic correction relatively comfortable, and obtained stereopsis.

Aniseikonia is obviously impossible in a person with a totally blind eye, but it occurs in rare instances in those with a central scotoma. Defects in peripheral fusion may cause discomfort, as pointed out by Burian.²⁰ However, since aniseikonia cannot be measured when the visual acuity is poor (20/50 or less), other treatment is indicated.

Patients are frequently seen with high corrected anisometropia and perfect comfort. Certainly, in such patients, it is best to leave well enough alone even if one eye is to suppress and eventually become amblyopic. If they are among those actually aniseikonic, they usually show defective stereopsis when tested on the space eikonometer.

For most occupations, binocular vision is not essential. Other factors being equal, a monocular individual drives a car as safely as a binocular. In fact, in close work, monocular workers are found more efficient and subject to less fatigue than binocular. However, any intelligent, cooperative child under the age of 12 years should be urged to develop acuity, fusion, and stereopsis.

To measure stereopsis, stereoscope cards are quite inadequate. Patients may measure 100 percent and not have enough stereopsis to make judgments on the

space eikonometer, and vice versa. The Howard-Dohlman test and the Verhoeff stereoptor are said not to repeat with precision, because the targets subtend too small a visual angle.¹² Experience on the space-eikonometer shows that stereopsis used to determine the position in space of an X-shaped string cross, movable about its center so that the top and bottom or either side may alternately approach the observer,¹³ must be of higher caliber than that necessary to pass the Howard-Dohlman or Verhoeff tests. Many with good judgment on the latter cannot, at least without practice, detect movements of the string cross.

Aniseikonia will solve many anisometropia problems. Some advise a full prescription to obtain high acuity, and tell the patient he must "get used" to the glasses. Others undercorrect, gaining comfort at the expense of acuity. It is likely that those patients who "get used" to such glasses either suppress or have axial ametropia, in which case there is no aniseikonia. In axial ametropia (that not due to curves of cornea or lens), the retinal-image size remains the same whether the eye is myopic or hyperopic, when the correcting lens is placed at the anterior focal point or 15 mm. from the cornea (Knapp's law). If the ametropia is lenticular or corneal, aniseikonia should be proportional to the anisometropia.

In anisometropia, the ocular image behind the more minus of the two refractive lenses is likely to be smaller, and for proper fusion needs magnification. In most of such patients the measured aniseikonia is about 1.5-percent magnification per diopter of anisometropia, at an ordinary eye-wire distance. However, an important group have aniseikonia measured on the "wrong" eye. For instance, if a patient wears: R.E., +1D. sph.; L.E., +4D. sph., one would expect him to require about 3- to 4-percent mag-

nification of the image of the right eye. In some patients, it might be measured over the left, or perhaps, not found.

It has been said that aniseikonic correction for an anisometropic patient may give him comfort by the simpler means of correcting the prismatic imbalance at the various angles of gaze. To refute this, is the large group of patients successfully treated in which the aniseikonia was prescribed over the "wrong eye," increasing any prismatic imbalance introduced by the anisometropia. The use of slab-off prism to correct prismatic imbalance in the reading position is logical, and does suffice for many patients.

A comparison of 100 patients treated successfully for aniseikonia with 100 patients apparently unable to wear aniseikonic glasses was made recently.¹⁴ Of the 200 patients there were 69 in whom the measured aniseikonia was about 1.5 times the dioptric difference in the two eyes, and was measured over the more myopic of the two eyes. Of these 69, 44 were among the success cases, and 25 were among the failure cases. Of the cases in which agreement of the measured with the estimated aniseikonia was in one meridian only, 29 were among the success cases, and 28 were among the failure cases. Of the cases not in agreement, 27 were among the success cases, and 47 among the failure cases.

This suggests that one is justified in prescribing aniseikonic lenses magnifying the image of the eye corrected for more hyperopia only when the measurement is satisfactory and repeatable with precision, and when temporary size fitovers are reported comfortable.

Aniseikonia may appear in patients due to facial asymmetry. There are many patients with slight unilateral enophthalmos, and so many with one eye higher than the other, that the headrest design for the new space eikonometers has been changed to adapt to such differences. Sup-

TABLE 1
NEGATIVE MAGNIFICATION PRODUCED BY TRIAL-CASE MINUS CYLINDERS
MM. REAR SURFACE TO CORNEA

	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1.2	.13	.14	.16	.17	.18	.19	.20	.21	.22	.23	.25	.26	.27	.28	.29	.30	.32	.33	.34	.35	.37	.38	.39
.25	.18	.20	.23	.26	.28	.30	.33	.36	.39	.41	.44	.46	.49	.52	.54	.57	.60	.62	.65	.67	.70	.73	.76
.50	.37	.42	.46	.52	.57	.61	.67	.71	.77	.81	.86	.91	.96	1.01	1.06	1.11	1.16	1.21	1.26	1.30	1.36	1.41	1.46
.75	.55	.62	.69	.77	.85	.92	1.00	1.07	1.15	1.22	1.29	1.37	1.45	1.42	1.60	1.67	1.74	1.82	1.89	1.97	2.04	2.12	2.20
1.00	.69	.79	.89	.99	1.09	1.19	1.29	1.39	1.49	1.59	1.69	1.79	1.89	1.99	2.09	2.19	2.29	2.39	2.49	2.59	2.69	2.79	2.89
1.25	.89	1.01	1.13	1.25	1.37	1.49	1.61	1.73	1.86	1.97	2.10	2.22	2.34	2.46	2.58	2.70	2.82	2.94	3.06	3.18	3.29	3.41	3.53
1.50	1.05	1.19	1.34	1.48	1.63	1.78	1.92	2.06	2.21	2.36	2.50	2.64	2.79	2.94	3.08	3.23	3.38	3.51	3.66	3.81	3.95	4.09	4.24
1.75	1.24	1.41	1.57	1.73	1.90	2.07	2.23	2.40	2.57	2.73	2.90	3.06	3.23	3.39	3.55	3.72	3.89	4.05	4.22	4.38	4.54	4.70	4.87
2.00	1.40	1.65	1.84	2.02	2.21	2.40	2.59	2.77	2.96	3.14	3.33	3.51	3.70	3.88	4.07	4.25	4.44	4.62	4.80	4.98	5.16	5.35	5.53

pose a 4-diopter bilateral hyperope has 2 mm. difference in eye-wire distance (cornea to eye-wire plane). He might have complaint from the 0.80-percent aniseikonia introduced. Geometrically, there is 0.1 percent of aniseikonia per diopter in the refractive lens per millimeter it is changed in eye-wire distance. Table 1 gives the minification of a number of trial-case minus cylinders in the power meridian at various eye-wire distances. (Such lenses must have plano front surfaces, or the curves will magnify and neutralize the minification at 0.25 diopters and smaller.) If a patient with the correction: R.E., +1D. sph.; L.E., +4D. sph., has measured aniseikonia of 2 percent in the right eye, it could be corrected in three ways. First, decrease the left sphere from a +4D. to +2D. Second, place the right lens at an eye-wire distance of 17 mm.; and the left one at a distance of 7 mm. (see table 1). Third, make the thickness and base curve high on the right lens, and low on the left lens. In simple prescriptions, this can sometimes be done by selecting proper Tillyer series lenses directly from stock, lowering the cost.

Aniseikonia may occur in emmetropic or isometropic eyes. At a naval station in 1942, 280 nearly emmetropic trainees were examined for aniseikonia. One was found to have 1-percent aniseikonia, eight had 0.75 percent, and 32 had 0.50 percent. Five cases with severe complaints relieved by afocal aniseikonic glasses occur in the Dartmouth Institute records.

ASTIGMATISM AND ANISEIKONIA

Astigmatism, being primarily corneal, is not commonly axial, and is therefore not subject to Knapp's law. In other words, astigmatism, if asymmetrical, should produce proportional aniseikonia. The experimental data tends to support this.^{19, 17} There is some variation in ob-

lique aniseikonia attributed to cyclophoria which interferes with the space-eikonometer test.

Oblique aniseikonia, an inevitable result of oblique astigmatism, results functionally in tipping of vertical contours in space. When a vertical line is viewed through a minus cylinder, the line appears to rotate, following the rotation of the cylinder. If cylinders (always minus in this paper) are placed before both eyes and rotated converging the axes down, a vertical line viewed by the right eye will appear to rotate clockwise, and that viewed by the left eye counter-clockwise. Although the eyeballs may rotate and the images fuse, from the center of the lines as a reference point, there will be uncrossed disparity above, and crossed disparity below. The result is that the fused line will tip away from the observer at the top and toward him at the bottom. The same effect is true of a wall, of a floor, or a table top. Making the cylinders converge above will reverse the effect.

Aniseikonic meridional lenses placed similarly before both eyes will have an identical effect without producing the blur that cylinders cause. These lenses are usually spoken of in the plus, or magnifying axis. Therefore, the correction of aniseikonia caused by converging-up high cylinders is accomplished by positive meridional magnifiers placed in axes likewise converging up. If the astigmatic axes converge down so should the axes of the correcting magnification.

Oblique aniseikonia is measured in terms of the sum of the arc degrees that each of the axes of these aniseikonic lenses must be converged up or down to correct the distortion of vertical lines in space in the target of the space eikonometer. Axes converging up is called plus, and down is called minus.

When all vertical lines are removed from the target, the X-shaped cross will

not tip in space with oblique cylinders, or with oblique meridional-size lenses. Oblique aniseikonia due to the equivalent of: R.E., $-2D.$ cyl. ax. 45° (or 135°); and L.E., $-2D.$ cyl. ax. 135° (or 45°) or more, is considered likely to require optical correction in most patients.

MADDOX-ROD TEST FOR ANISEIKONIA

There are means available to the refractionist by which, in his own office, he can test for aniseikonia by its effect on space perception. This can be done in 10 minutes on the space eikonometer. The same target could easily be set up by a handy man. Requiring even less equipment, however, is the Maddox-rod test, which has not previously been described.

The set up may consist of several flash-light bulbs with push pins, wire, and transformer, arranged so that the lights can be placed in various positions on a dull-black fiberboard background centered near the eye level of a seated patient, perpendicular to his line of vision. Any set of trial-case minus cylinders which have plano front surfaces would be satisfactory.

Place the Maddox rods as in Figure 2(a) to obtain a binocular image of two vertical streaks from two small "muscle lights." The streaks will appear at unequal distances from the observer, if axis- 90° aniseikonia is present, just as in the space-eikonometer target¹³ (fig. 1). Axis- 180° aniseikonia is estimated as in Figure 2(b) where there are three lights, one in the center of each line drawn. Black-tape masks on each Maddox rod produce the target as shown.

If the upper-half lines are not level, aniseikonia is present, just as in the ophthalmoeikonometer target.¹⁸ In the more detailed directions to follow, the measurements of target distance and visual angle given may be varied for convenience, but are known to give comparable results

with the standard techniques when a 4-foot board and a 6-foot working distance are used. The target lights should not subtend the same angle as the blind spot and the visual axis. If patients have poor stereopsis or fixation, use absolute darkness and dim target lights. In most cases, a small light behind the patient will not interfere.

Place the refractive prescription in the trial frame or phoropter so that any sphere over the right eye is at the same

tral axes of the lenses, and adjust the corneal alignment to equalize the eye-wire distances.

To measure axis-190° aniseikonia, pin two target lights on the central horizontal line of the board, 14 inches apart, equidistant from the patient's eyes. Then place the Maddox rods in the trial frame so that two parallel, vertical lines are seen by each eye. Take care that the lines are fused. Place a minus cylinder axis 90° lens out in front of the trial frame before one eye,

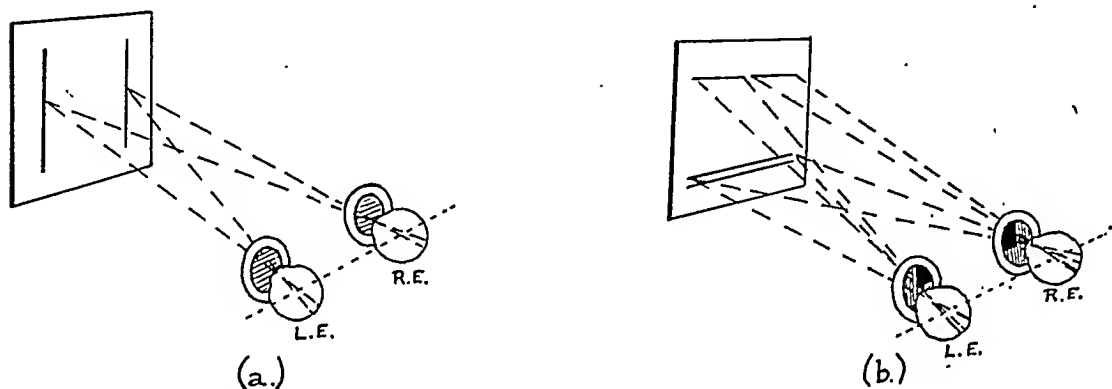


Fig. 2 (Miles). The Maddox-rod test for aniseikonia. (a) Axis 90°. (b) Axis 180°.

eye-wire distance from any sphere over the left eye. If the trial case carries no 0.00 lenses, simply add 0.12D. to both sides. For instance, in the prescription: R.E., +1D. sph. \ominus -0.50D. cyl. ax. 180°. L.E., 0.00, place in the trial frame: R.E., +1.12D. sph. \ominus -0.62D. cyl. ax. 180°; L.E., +0.12D. sph. \ominus -0.12D. cyl. ax. 180° to balance the amount of glass on both sides. Theoretically the central thickness of all lenses used should be equal, because of the magnification factor due to thickness. The Maddox rods can be placed anywhere in the frame, but the images are larger and more sensitive when they are nearest the eyes. However, when masks are used to test axis-180° aniseikonia, the farther the Maddox rods are from the eyes, the greater the precision: Maddox rods as high as 2½ inches in diameter are made, and would make a large target. Center the pupils on the cen-

tral axes of the lenses, and adjust the corneal alignment to equalize the eye-wire distances. To measure axis-190° aniseikonia, pin two target lights on the central horizontal line of the board, 14 inches apart, equidistant from the patient's eyes. Then place the Maddox rods in the trial frame so that two parallel, vertical lines are seen by each eye. Take care that the lines are fused. Place a minus cylinder axis 90° lens out in front of the trial frame before one eye, and ask the patient which of the two vertical lines seems nearer to the eyes. The line on the same side as the eye over which the cylinder is placed will appear nearer than before. If there is inequality, vary the power of the cylinder used, until a lens is found which will equalize the distances of each vertical line. Place this lens in the front cell. Refer to Table 1 to determine its axis-90° aniseikonia. Test the sensitivity by finding the smallest lens that will displace the lines equally when held alternately before the two eyes. This lens may be a -0.12D. cylinder in one with normal stereopsis.

Some aniseikonic patients arrive at a point where the lines appear equidistant, but will see movement with a given cylinder placed over one eye when there is no movement with the same cylinder placed over the other eye. In the eikonometers, there is no analogous problem,

as sensitivity is tested by enlarging or minifying the image seen by one eye alone. If the right eye happens to be the one involved, the space-eikonometer test now in use simply registers poor axis-90° sensitivity and an unsatisfactory prescription. A. Ames, Jr., explains that there is habitual suppression in the eye which is not sensitive. This is presumably the mechanism by which stereopsis impulses are suppressed in the normal eye, as in the experiment early in this paper where one arm is seen to be shorter than the other. The background part of the image of one eye is suppressed axis 90°.

To test a patient for axis-180° aniseikonia takes more time, and requires "fussy" technique. Three lights are pinned on the vertical central line of the board, about 20 inches apart, with the extra light 2 inches below the lower one. Black tape is placed over the upper inner quadrant of each Maddox rod, when they are placed to produce horizontal lines. The two lower lines are fused below, while the upper one is divided by the masks into halves. The two tips should be completely separated about 2 inches. There is a tendency for the eyes to converge and diverge on this target in a dark room, due to absence of any vertical object for binocular fixation. If the masks are properly placed (they must cover more than one quadrant), the tips of the upper lines can be made to approach and recede by the patient manipulating the interpupillary distance knob, while the test is going on. Do not let the tips touch, or there is no sensitivity at all. Keep the head at the proper elevation. It may help to draw a picture.

One patient tested (R. B., a boy, aged 18 years) had intermittent exotropia of 30 diopters, but was not handicapped by this variability. His sensitivity on the test was ± 0.5 -percent magnification, which is comparable to that shown by him on the space eikonometer.

If the left half line, seen by the left eye, appears higher, place a cylinder axis 180° before it of such power that the two half lines appear level. Then test the sensitivity as before with a small cylinder-held axis 180°. Hyperphoria will interfere with sensitivity, and must be corrected. A prism placed in the system does not have to be balanced on the other eye because no curved surface is involved.

In hyperphoria, there is error in this test due to fixation disparity. Therefore, if it is present, invert the target described above for axis 180°, and place the masks on the lower inner quadrants of the Maddox rods. Repeat the above tests, and take the average. Transpose the power and eye-wire distance of the cylinder required into aniseikonia by use of Table 1. Since the table gives minification, the amount should be transferred to the other eye and called magnification to conform to custom.

An analogous method will test axis-90° aniseikonia in patients who have stereopsis too deficient for the method described above. If the patient has pin-point pupils, there will be little sensitivity with the mask tests until the pupils are dilated. Axis-45° or 135° (oblique) aniseikonia cannot be measured by the Maddox-rod method. A mosaic Maddox rod has been made which by producing two lines at right angles could duplicate the target of the space eikonometer. However, since one would need a trial set of aniseikonic lenses, it would be better to set up a string target.

The fusion pattern in the Maddox-rod, axis-180° test is two lines instead of one in order to improve the accuracy of peripheral fusional movements. In this target, the peripheral retina is used. If the visual angle of the elements is too great, judgment is based on images seen with poor acuity. When the angle is too small, the special effect of aniseikonia on the target elements is too small for precision.

The standard space-eikonometer target subtends 9 arc degrees at 10 feet, and the ophthalmo-eikonometer target subtends 4 arc degrees at 20 feet. The space-eikonometer test for 13 inches gives comparable results to those at 10 feet, but similar tests on the ophthalmo-eikonometer for near show wide variations. The "normal" exophoria for near may account for this finding. It is assumed that aniseikonia does not vary with the distance.

Minus cylinders can be used instead of aniseikonic, afocal trial lenses in the Maddox-rod test, because the targets used consist of parallel lines in the same axis as that of the cylinder used. There is no blurring. It can easily be shown on the space-eikonometer, axis-90° target that the subjective aniseikonia measured for various minus cylinders axis 90° up to 2 diopters before one eye produces a straight line graph which corresponds closely to the actual magnification of each cylinder as shown in Table 1. Above 2 diopters accommodation interferes with the test by blurring the lines.

An aniseikonic, trial-lens set would contribute to accuracy in the Maddox-rod test because the lenses would not have to be placed in the precise eye-wire distance that minus cylinders require. Whereas, a minus cylinder will double in aniseikonic magnification in the range between 9 and 22 mm. eye-wire distance, the aniseikonic trial lens will vary insignificantly.

It is obvious from Table 1 that, in measuring and prescribing aniseikonia, all refractive and measuring lenses in the trial frame during measurement must be placed at known distances from the cornea. Otherwise, magnification differences between the eyes cannot be calculated. This fact has discredited all screening devices attempted in the past.

Patients with anomalous retinal correspondence cannot be tested on aniseikonia instruments, because of the extramacular fixation. Anomalous fixation is preferred

even though normal macular visual acuity is present in the deviating eye. To remove the features of the target objectionable to the cerebral macular fusion centers, all peripheral detail in the visual field must be eliminated. This is not effected in any of the ocular-testing devices in common use. Ordinary retinal images are too complex to fuse in these patients, so the less critical anomalous retinal center is used.¹⁰

A patient (R. B., a boy, aged 10 years) was found to have sometimes normal and sometimes abnormal correspondence on the after-image test. Invariably he showed abnormal correspondence on the synoptophore. In a darkened room free from peripheral fusion contours of any kind he used normal correspondence. On the space eikonometer, he saw the target without apparent suppression or diplopia, but was insensitive to aniseikonic changes. On a similar target produced by Maddox rods in a totally dark room, he was sensitive to changes of ± 1 percent, axis 90°.

OTHER EXPERIMENTS WITH PAIRED MADDOX RODS

Place Maddox rods over each eye as in the test for cyclophoria, with a base-down prism over one eye. Set the lines horizontal and parallel, and remove the trial frame carefully. Hold it so that by moving the head up and down, the observer can exert vertical eye movements while looking at the single target light. On looking up, the patient should see the lines converge on the right (incyclophoria), and on looking down, the opposite. These rotary eye movements are best seen at 20 inches, due to the increased stretch and leverage of the oblique muscles during convergence.

Put the trial frame on the patient, adjust the lines parallel, and demonstrate that minus cylinders with axes converging up will make the parallel lines appear converged on the right. Likewise, making

the axes converge down the lines appear converged left. Most persons can detect this change with -0.25 -diopter cylinders. Now, presuming the prism could be removed from the trial frame without changing the setting, the lines could be fused. Such fusional movement produced by minus cylinders converging up would be incyclovergence, and vice versa.

In testing cyclofusional amplitudes, there is a great difference in results depending on the target used. For instance, in using a printed page, cyclofusional amplitudes are surprisingly high, possibly 15 degrees, when tested at the reading distance. When using two vertical lines produced by two Maddox rods, the rotation of the rods necessary to cause doubling may be as high as 10 degrees, compared to about 4 degrees when the lines are seen horizontally. When the lines are seen vertically, and are rotated equally in opposite directions, each eyeball rotates slowly with its line, keeping the fused lines in the sagittal plane but tipped. Due to the phenomenon of stereopsis in horizontally disparate points on the "X," the crossed disparate points are seen as a more distant part of the line using the center of the "X" as the point of reference. This maintenance of fusion requires cyclofusional ocular movements which are very slow, often one second of time per degree rotation of the lines. If only one Maddox rod is turned, the resulting innervations for cyclofusional movements are distributed equally between the two eyes,²¹ and both will turn through equal arcs as long as fusion holds. In this case, the fused line rotates subjectively on a frontal plane as well as on the sagittal plane, and the measured amplitude is only about two-thirds the amount measured if the Maddox rods are rotated equally.

Suppose the patient observes fused vertical lines produced by two Maddox rods, and adjusts the rods so that the fused line appears vertical in both the sagittal

and frontal planes. Suppose the reading of the Maddox-rod marks on the trial-frame axis scales are not both 90° , but one is 88° and one is 92° . Two conditions might cause such an error: cyclophoria and oblique aniseikonia. Cyclophoria can be partially corrected in patients with astigmatism or meridional aniseikonia by proper lenses.

There is an interesting test for stereopsis using Maddox rods. It is astonishing at first sight, because the cause is not immediately evident. Place two lights on the board 6 inches apart on an oblique line about 45 degrees from the horizontal in either direction. Place the Maddox rods to make a pair of vertical fused lines. Then slight rotary movements of one or both of the rods will make the lines appear to advance and recede alternately from the observer for several inches.

Another test with binocular Maddox rods has some theoretical significance in regard to the horopter, and possibly in regard to phorias and fixation disparity. Place three lights on the central horizontal line equidistant, and observe them from a point equidistant from the lateral two. Place Maddox rods over both eyes, so that three fused vertical lines are in view. Some observers will see the center line in front of the plane of the other two, while others may say it is behind. The latter is "normal," at a 6-foot distance. Rare individuals have a tremendous error, which is not merely poor stereopsis.

The phenomenon could be due to the variations of the normal asymmetry in space value of the elements of the nasal and temporal halves of the retina. Given any three vertical lines on a frontal plane, with monocular vision, a normal person will not be able to place the center line exactly equidistant to the other two lines. Using the right eye, some persons will place the center line slightly nearer the right line, and others will place it consistently nearer the left. The error

is often in opposite directions in the two eyes, but is sometimes the same. If two such figures were drawn, and presented in a stereoscope before the two eyes for fusion, the center line would be off the plane of the outer two because of its disparity.

Phenomena of rivalry between the two retinas are readily and strikingly shown by Maddox-rod targets. Pin several lights on the board in an oblique line. In the trial frame, place the Maddox rods with their axes converging so that the binocular view is a field of oblique lines at right angles. After a few minutes staring at this target, a normal person notices a constantly changing patchy disappearance of parts of the pattern. The more lights, the more active the patchy suppression becomes. Any movement of one Maddox rod will cause the other eye to suppress completely for a moment (as in the major amblyoscope). A prism placed before one eye will likewise cause the other eye to suppress.

CONCLUSION

Present beliefs of the author on factors in the diagnosis of aniseikonia are

outlined in a simple manner in the hope of making it easier for the profession to get a foothold in this advanced field. Any patient may have aniseikonia who is not given comfortable vision and stereopsis by the usual procedures, especially when they have anisometropia, high ametropia, or oblique astigmatism.

Tests for stereoscopic acuity are discussed. Those in common use are said to be inadequate because the target angle subtended is too small and the target consists only of vertical and not oblique lines.

Binocular noncycloplegic methods of refraction receive attention. Patients with high oblique astigmatism should be corrected by cylinders at an axis determined when the eyes are fixed on the same point, with enough peripheral detail present binocularly to prevent rotational incomitance.

A method of measuring aniseikonia with paired Maddox rods is described, and various practical matters discussed. This and other Maddox-rod tests are offered for the purpose of teaching and for practical office use.

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DETACHMENT OF THE CHOROID AND THE RETINA

ANATOMIC AND OTHER CONSIDERATIONS IN THE DIFFERENTIAL DIAGNOSIS

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The differential diagnosis between detachment of the choroid and serous separation of the retina, the presence of an intraocular tumor or retinal cyst having been ruled out, is, according to Duke-Elder,¹ ordinarily not difficult, "the solid appearance of the choroidal detachment, its smooth surface (not wavy or mobile as in retinal detachment), and the appearance of normal retinal vessels with their color unchanged, being sufficiently apparent points of differentiation." Shallow or empty anterior chamber, folds in Descemet's membrane, and hypotony occurring in postoperative cataract and glaucoma cases led O'Brien² to suspect detachment of the choroid. Verhoeff³ goes further, stating that, given the above characteristic ophthalmoscopic findings and Hagen's⁴ sign of exaggerated translucency on transillumination, "the diagnosis is certain" and knowledge of previous wound leakage or obliterated anterior chamber is not essential for the diagnosis.

However, the diagnosis is not always easily made, as witness the case reported by Spaeth and DeLong,⁵ of what ap-

peared at first to be choroidal detachment following shortly after corneoscleral trephination. Six months later with the finding of impaired transillumination after cataract extraction, the case was considered to be one of old, stationary retinal detachment due to an unrecognized neoplasm. Since no tumor cells were present in the xanthochromic, viscous "subretinal" fluid obtained by transscleral diathermy punctures, which resulted in reattachment, the final diagnosis was that of unresolved subchoroidal hemorrhage dating from the trephining operation. The case of Verhoeff and Waite,³ which was proved by microscopic examination to be one of spontaneous detachment of the choroid, had been originally diagnosed as separation of the retina.

The ophthalmoscopic picture may be further confused by the coexistence of choroidal and retinal detachment. However, except in those eyes badly damaged by plastic or suppurative iridocyclitis and severe trauma, this condition appears to be very rare, and choroidal detachment seems to be the primary lesion. A search of the literature reveals only seven cases,

although others may have been observed but unreported.

Duke-Elder¹ states that retinal detachment does not follow postoperative choroidal detachment, but may complicate unexplained or spontaneous cases, while Meller⁶ mentions retinal separation as complicating both delayed postoperative (type 2) and spontaneous (type 3) choroidal detachments. Hudson⁷ in his examination of 574 eyes found 153 cases of choroidal detachment. In only one of these was there coexisting myopic separation of the retina. Simon⁸ observed the combined conditions in a case of cyclic albuminuria. Elschmig's⁹ case was that of a middle-aged man in whom the choroidal detachment was assumed to be primary and the retinal separation to be secondary. Recovery followed aspiration of the subchoroidal fluid.

Purtscher¹⁰ reported a case, due to diffuse episcleritis and serous tenonitis, in which he considered the choroidal detachment and complicating retinal separation to be a collateral edema; and the reattachment occurred after subsidence of the tenonitis. In Ziporkes's¹¹ interesting case, there were undulating folds in the temporal retina and a choroidal detachment in the extreme upper temporal periphery associated with a mixed tumor of the lacrimal gland. Following removal of the tumor, both the folds and the detachment subsided.

Extensive retinal separation following choroidal detachment, which developed after combined intracapsular extraction, has been observed by Kirby¹² in a patient afflicted with osteochondrodystrophy and general maldevelopment, and complete reattachment was obtained by extensive surface and penetrating diathermy and trephine-drainage openings.

In Case 11 of the series of Spaeth and DeLong⁵ choroidal detachment developed after the removal of steel wire from the

vitreous via the anterior route, subsided spontaneously, and was followed three months later by retinal separation in the same area. Full recovery followed operation. The choroidal detachment was considered to be the result of trauma and a surgical procedure, and the retinal separation was probably due to uveitis set up by the original damage to the choroid.

Another case, that reported by Nelson¹³ as total retinal detachment following intracapsular cataract extraction with spontaneous reattachment after an acute attack of glaucoma, is worthy of note. Both the present writer and his associate, Dr. K. H. Chapman, had previously interpreted the detachment as choroidal, not retinal.

CASE REPORT

In view of the rarity of spontaneous reattachment of serous retinal separation and the even greater infrequency of retinal detachment complicating choroidal detachment, it would seem proper and of some interest to record my observations in the case reported by Nelson¹³ and to use it to illustrate some features which may prove helpful in the differential diagnosis.

Mr. H. T. W., aged 79 years, was first seen by me on October 20, 1942, giving the history of gradually failing vision in the left eye for the past 12 years, and in the right eye for two years. He had suffered a blow on the left eye, cutting the globe, some indefinite time ago, but apparently no visual damage resulted. He had seen another oculist the previous July or August and was given some drops for the right eye, which he did not use for very long. The patient was obviously senile, and the family commented that he was hard to handle. An attack of blindness following an abdominal operation in 1925 was not mentioned.

The vision of the right eye was reduced to counting fingers at one meter in

the temporal field; that of the left, to light perception and full projection. The right eye was in a state of well-advanced, chronic, simple glaucoma. The macula appeared finely pigmented and slightly edematous, and many drusenlike spots were grouped around the posterior fundus. A hypermature cataract was present in the left eye. Otherwise the eye appeared normal. Tension was: R.E., 30 mm. Hg (new Schiøtz); and L.E., 18 mm. Hg. Testing of the right visual field revealed an irregular, absolute central scotoma of about 8 degrees in diameter and contraction of the upper nasal field to within 20 degrees of fixation for a 1-degree form on the Ferree-Rand perimeter. The diagnosis was: R.E., advanced, chronic, simple glaucoma and senile macular degeneration or central angiospastic retinopathy; L.E., hypermature senile cataract. Miotics were prescribed for the right eye, and cataract extraction of the left eye with guarded prognosis (because of the possibility of bilateral macular pathologic conditions) was advised. Physical examination showed moderate arteriosclerosis, blood pressure 140/75 mm. Hg, inguinal hernia, moderate benign prostatic hypertrophy, internal hemorrhoids, and an operative scar in the epigastrium.

Intracapsular combined cataract extraction was performed on November 17, 1942, under local, cocaine anesthesia, O'Brien akinesia, and retrobulbar injection of 2-percent novocaine and adrenalin. A Stallard corneo-episcleral suture was used, and the limbal corneal section with the Graefe knife included a narrow conjunctival flap above. The anterior chamber was not irrigated, and, after tying the suture, no further procedures other than binocular bandaging was necessary. Homatropine had been instilled preoperatively. The postoperative course was completely uneventful; the

chamber was fully reformed and the iris pillars were in perfect position at the first dressing on the second postoperative day. The corneal suture was removed on the 10th postoperative day, when the eye appeared quiet, the media clear, and the fundus normal except for some grayish mottling of the macula, seen best with yellow light. The wound looked well healed, although biomicroscopy showed a few folds in Descemet's membrane and slight herniation of the vitreous through the pupil. Tension was: R.E., 23 mm. Hg; L.E., 7 mm. The tension varied only slightly during the remaining five months of my service, the highest tonometric reading being R.E., 26 mm. Hg, and L.E., 12 mm. in mid-December. One month postoperatively vision was: O.S., with a +10D. sph. \ominus +3D. cyl. ax. 2° = 0.9. This temporary glass without reading addition was ordered. In February, 1943, three months after operation, a mild attack of acute iritis developed with reduction of vision to 0.2. The condition completely cleared up under a regime of atropine, conjunctival packs of Pregl's solution, two intravenous injections of typhoid H antigen (10 and 20 million organisms, respectively), sulfadiazine (45 gr. daily for 4 days), and treatment of a rather severe rhinitis which was worse on the left side. The vision improved slightly, but was only 0.3 with a somewhat changed correction on March 19, 1943, when all evidence of active iritis had disappeared. There were the residua of faint pigment deposits on the anterior vitreous face and a thin ring of organized exudate around the pupil margin. Fundus examination showed the media to be clear, and in the macula were seen fine, closely packed white dots and three minute hemorrhages at the end of an inferior macular arteriole. A small pigmented patch was noted in the far upper periphery. Mercury, KI, and vitamin-B

complex were prescribed. One week later the vision had dropped to 0.1, but no central scotoma for 1/1,000 or 2/1,000 white or 5/1,000 and 10/1,000 red and green could be detected. However, blue could not be recognized. The blind spot was normal, and the peripheral field was full. It is believed, however, that had one been able to test the patient with binocular fixation on the stereocampimeter, an absolute central scotoma would have been found. Central retinal angiospasm was considered the most likely cause. According to Peter¹⁴ early loss of blue vision indicates disease of the neuro-epithelium, while red and green changes are noted first in lesions of the conducting paths and centers.

On April 9, 1943, almost five months after operation, the phase of detachment began. However, on that day central vision had improved to 0.6 with a correction of a: +11D. sph. \subset +2D. cyl. ax. 45°. Objectively, the anterior chamber was almost empty, the eye was soft, and in the temporal fundus was seen a dark, smooth-surfaced hemispherical mass elevated almost to, but not obstructing, the visual axis. This was interpreted as a classical picture of choroidal detachment by the author and the consultant, Dr. K. H. Chapman. No leak could be demonstrated in the apparently well-healed operative wound. The patient was hospitalized, and bed rest and binocular bandaging were ordered. Saline cathartics, a general diet of whatever the patient wished (because of his "touchy" digestion), continuation of thiamin chloride, and instillations of atropine in the left eye and miotics in the right, constituted the rest of the treatment. Daily fundus examinations showed no change until the fourth day, when the temporal detachment had increased so that it now covered the visual axis, and a similar dark, globular, but less extensive and less elevated

mass was seen in the inferior periphery, with a deep valley between it and the temporal one. No retinal hole nor any sign of serous retinal detachment was found; and the retina did not appear translucent to retro- or para-illumination with the ophthalmoscope. This method of lighting up the surrounding separated retina by throwing the narrow, bright ophthalmoscopic beam slightly off the area under study, a method described by Reese¹⁵ to demonstrate cystic spaces in the macular retina, has been found very useful in differentiating serous and solid separation of the retina.

After 10 days of hospitalization, during which time the patient's coöperation was practically nil (he even made a clandestine trip out of the hospital), the family was consulted and the joint decision to dismiss him to his home was made. He did not return to our care after that.

The further course of the condition has been reported by Nelson,¹³ whom the patient consulted two months later. At that time, the detachment was found to have extended into the nasal fundus, mild iritis had recurred, and a gray film had appeared on the upper quadrant of the posterior corneal surface and in the coloboma, which was considered to be an ingrowth of epithelium. The visual field was lost nasally, this defect being almost exactly the inverse of the detachment in the temporal fundus as we first observed it. The fundus picture continued unchanged until spontaneous reattachment occurred sometime between August 25, and October 1, 1943, that is 4½ to 5½ months after onset. An acute attack of glaucoma had supervened and subsided in July. Full recovery of central and peripheral vision eventually resulted.

This case has many interesting features:—the persistent, postoperative hypotony, inexplicable except on the as-

sumption of microscopic, but clinically undemonstrated, wound leakage or disturbed intraocular vascular balance, as evidenced by chronic simple glaucoma in the right eye, central angiospastic retinopathy in both eyes, acute glaucoma in the left eye, and generalized arteriosclerosis; the delayed onset of the detachment; its extent and size; the supervention of acute glaucoma; and the spontaneous reattachment and recovery of vision approximately five months after onset of the detachment and, even more interestingly, two or more months after subsidence of the acute glaucomatous attack.

The causation of postoperative hypotony and its role in the development of choroidal detachment, the variability of time of onset and duration, the complications, and the prognosis have been thoroughly discussed by the several authors cited above. The matter of size and location has also been considered, first, by Fuchs¹⁶ who stated that choroidal detachments are limited by the vortex veins above and below in the region of the equator so that they occur most often in the nasal and temporal quadrants.

Duke-Elder¹ says that the usual sites are the inferior, inferonasal and inferotemporal quadrants, and occurrence in the upper quadrant is rare; and the detachment may be large enough to occupy half of the fundus and reach back to the disc, and may occasionally extend around most or all of the globe.

Samuels,¹⁷ in differentiating hemorrhagic and serous choroidal detachment, states that both blood and serum are found in greater accumulation in the region of the ciliary body, but, in extending posteriorly, blood may dissect the choroid from the sclera as far back as the optic nerve, while serum is usually confined to the normal narrower limits of the perichoroidal space.

O'Brien,² in his large series of postoperative cases, found that detachments appear first in the periphery and sometimes encircle it, are most often more extensive nasally and temporally than inferiorly, are sometimes flat but more usually elevated into one or more domes, but in no case do they reach backward to the macula or the nerve head. However, in one of his cases the choroidal detachment was massive enough to appear to fill the vitreous chamber. In our patient the temporal detachment was extensive enough to obscure the visual axis and a view of the macula, although it did not reach to the nerve head. Nelson¹³ was of the opinion that a choroidal detachment of the extent seen in this case would be impossible without tearing the vortex veins so that devastating subchoroidal hemorrhage would result.

These various observations are in general, but only general, agreement, and they pose an intriguing anatomic problem. Specifically, how extensive and where can choroidal detachments be without damaging the vortex veins and their ampullae? The solution of the problem may be found by the application of the fundamental principles of physiologic optics and descriptive geometry,¹⁸ a method which I have used in my investigations in intraocular localization.¹⁹ By this method it can be shown to what extent the vortex ampullae limit the height and size of choroidal detachments in the different quadrants and zones of the eye, and an additional factor, that of location, may be brought out to aid in the differential diagnosis between choroidal detachment and serous separation of the retina.

The first step in the solution is the construction by orthographic projection on cross section paper, scale 10 to 1, of frontal, top (horizontal meridional), and profile (vertical meridional) views of a spheric anatomic eye whose dimensions

are the average measurements of normal eyes found in the literature,¹⁹ and the schematic eye of A. Cowan.²⁰ Next are plotted the positions of the vortex veins and ampullae, using the external topographic data of T. Cowan²¹ and the retinal coördinates for intraocular localization.¹⁹ The average distances of the respective vorticoses veins behind the limbus and their meridians of longitude measured with a protractor on Cowan's projection (fig. 1), are as follows:

mm. being attained by the superior temporal vein only. To assure ample clearance of the ampullae by the detachments the maximal diameter (0.5-2 mm.) of the ampullae has been used. Figures 2 and 3 show the average positions of the vortex veins, their ampullae, and other normal ocular structures orthographically in frontal, top, and right-side views of the right eye.

In orthographic projection, unlike perspective or pictorial presentation, the

TABLE I
AVERAGE POSITION OF THE VORTICOSE VEINS

Exits of Vortex Veins				
	S.N.	S.T.	I.N.	I.T.
Distance from limbus (LScS)	19.3 mm.	20.2 mm.	18.0 mm.	17.4 mm.
Corresponding perimetric sighting angle (\angle Ro)	38.8°	36.2°	43.8°	46.0°
Meridian, measured from vertical (90°) meridian	39.0°	20.0°	38.0°	9.0°
Vortex Ampullae				
	S.N.	S.T.	I.N.	I.T.
Distance from limbus (LScS)	16.3 mm.	17.2 mm.	15.0 mm.	14.4 mm.
Corresponding perimetric sighting angle (\angle Ro)	49.7°	46.7°	54.5°	57.7°
Meridian, measured from vertical (90°) meridian	39.0°	30.0°	36.0°	17.0°

The oblique intrascleral course of the vortex veins is 3 to 4 mm. in length. In Table 1, the ampullae have been placed at the average distance of 3.0 mm., anterior to the exits of the veins along the meridians of the exits of the veins, which results in an intrascleral length of vein to ampulla of somewhat more than 3 mm. but less than 4 mm., owing to the oblique course of the vein on a great circle to the meridian of the ampulla. This is in accord with the data given by Salzmann,²² who gives the usual length of the emissaria as 3 mm., a greater length of 4.6

lines of sight are assumed to be parallel to one another as if the observer were at an infinite distance from the object; and if the direction of sight is perpendicular to the face of the object, the orthographic view shows the true shape and size of that face. A choroidal detachment protruding into the vitreous chamber may be considered to be a portion of a sphere of the same radius of curvature as the normal (undetached) choroidal sphere, and the geometric problem is, therefore, that of the intersection of two spheres which may be solved by the method of cutting

planes. The axis or central meridional plane of each of the detachments was located equidistantly between the meridians of the ampullae, and, inasmuch as these axial meridians do not coincide exactly with the horizontal or vertical meridians, the top (fig. 2) and right-side (fig. 3) views are composite showing the vortex veins and their ampullae in their true positions while the detachments are shown as they would appear in auxiliary oblique views perpendicular to the axial meridional planes (Ad). The plane of intersection of the two spheres is a straight line (a-a', c-c', and so forth), when viewed perpendicularly to the meridional plane, and it will be noted that these lines of intersection, where the edges or borders of the detachments meet the normal surface, have been placed so that the vorticosc ampullae have been amply cleared. One may visualize these relations more easily if the frontal views be revolved about the anterior-posterior optic axis (AP) so that the detachment axes (Ad) be made to coincide with the vertical (90°) meridian in the case of superior and inferior detachments (fig. 3), and with the horizontal (180°) meridian in the case of temporal and nasal detachments (fig. 2). In this way the cross-section lines of the graph paper could be used for both views and the work reduced to two drawings. A simple model such as a hollow rubber ball indented to any desired degree up to the maximum, and viewed from different angles, will help to demonstrate these relations.

The line of intersection having been determined (for example, anterior to the ora serrata, c' , to the posterior fundus, c , in the temporal quadrant), it was easy to draw the frontal view by the method of cutting planes. The constructions show conclusively that a choroidal detachment in the temporal quadrant (fig. 2), assuming that its anterior border be in the re-

gion of the ora, d' , or in the ciliary body, c' , may be so extensive as to cover the visual axis and obscure the ophthalmoscopic view of the macula and the posterior pole, whether the determining rays pass through the posterior nodal point (N), or the pupil of exit (P_x), without damage to the vortex ampullae. Similarly, a nasal detachment may appear to reach

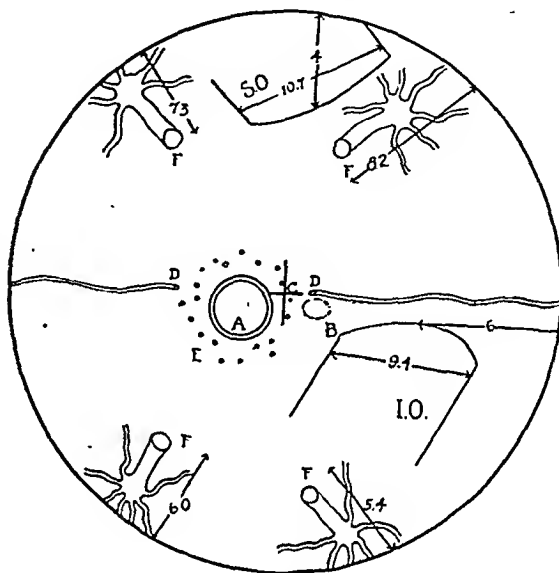


Fig. 1 (Stine). Projection of the posterior half of the globe measured on the sclera; A, optic nerve; B, macula; C, posterior pole; D, long posterior ciliary arteries; E, short posterior ciliary arteries; F, vortex vein with ampulla and tributaries. (Cowan.)

almost to the nasal margin of the optic disc. Superior and inferior detachments (fig. 3) must be smaller if their anterior borders are in the region of, or anterior to the ora serrata, but they can extend back to the nerve head or posterior limits of the suprachoroidea, if their anterior borders are situated posterior to the equator. If the detachment involves the entire expanse, a transverse fold or valley will be seen in it just behind the equator. Nevertheless, peripheral detachments in these quadrants will appear somewhat larger in the ophthalmoscopic panorama than in the orthographic view,

as they may be seen to extend back of the equator to within 45 degrees of fixation (or the posterior pole) with a meridional or transverse spread of 45 degrees or more. In any case, serous choroidal detachments are limited to the quadrants

on the shape of the globe, and rigidity or elasticity of the choroid and retina, and the effect of gravity on the subchoroidal fluid.

The surface area of the detachment, however, must obviously equal the sur-

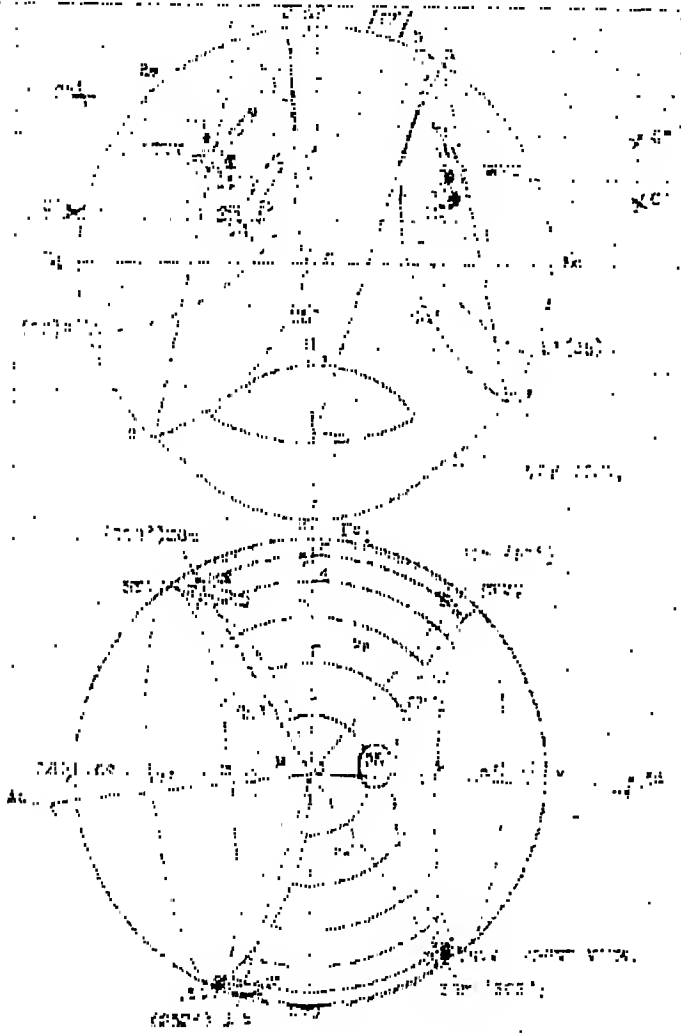


Fig. 2 (Stine). CHOROIDAL DETACHMENT. Frontal and top (equatorial and horizontal meridional) sections of schematic and average anatomical right eye, showing maximal possible extent of choroidal detachments in the temporal and nasal quadrants, scale 5:1. A, apex of cornea; P, posterior pole of globe and optic axis; M, macula; ON, optic nerve; L, limbus; Re, normal retinal or choroidal surface; Eq, equator; OS, ora serrata; STVV, ST, superior temporal vortex vein; Am, ampulla; SN, SNVV, ITVV, IT, INV, IN, superior nasal, inferior temporal, inferior nasal veins and ampullae; Ch', detached choroid; Ad, meridional axis of detachment; C, center of retinal or choroidal bulbar sphere; C', C'', C''', and so forth, centers of detachment spheres; a-a', c-c', planes of intersection of the two spheres (detached surface meets normal surface); ⊗, position of center of ampulla in auxiliary views to determine ample clearance of ampullae; 1, 2, 3, and so forth, latitude circles of 10°, 20°, 30° on normal retinal surface ($\angle Ro$); 0, 90, 180, meridians of longitude radiating from anterior and posterior poles; 30m, 39m, and so forth, meridians of ampullae referred to vertical meridian; b-b', d-d', other possible positions of choroidal detachment; N-M, Px-P, determining visual rays, or ophthalmoscopic lines of sight in vitreous. (Note: Latitude circles anterior to equator, on or under surface

of detachments are not shown. Outer scleral wall, ciliary body, and so forth are not shown.)

between the ampullae, or to the region anterior to them, where they may encircle the fundus; and if they are adjacent (for example, temporal and inferior), there will be a deep valley between them extending down to the normal retinal surface in the region of the ampulla.

Detachments need not be sections of a perfect sphere; their shape will depend

face area of the bed from which it is elevated. The true size and shape of detachments, choroidal or retinal, may be determined by plotting orthographically the data obtained by perimetric sighting of the edges along different meridians as pointed out previously,¹⁸ a method which I hope to describe more fully in a later paper.

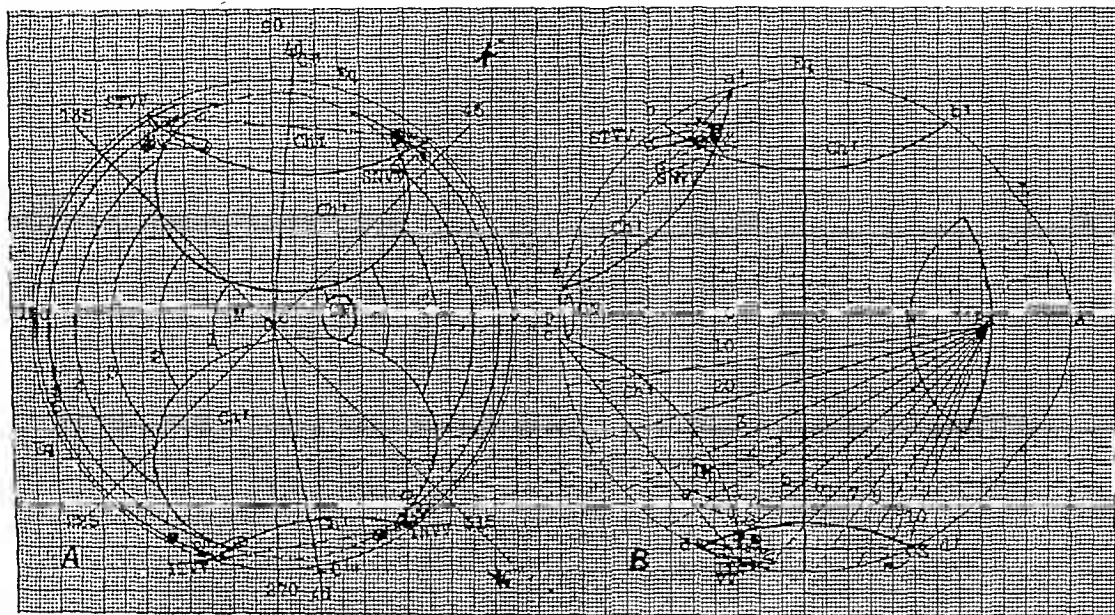


Fig. 3 (Stine). CHOROIDAL DETACHMENT. A, Frontal, and B, right side, (vertical meridional) views of right eye, scale 5:1. See Figure 2, for legend. 0-90, determining visual rays from Px in vitreous which will emerge from the eye making those angles ($\angle Ro$) between ophthalmoscopic line of sight and optic axis.

SUMMARY

The differential diagnosis between detachment of the choroid and serous separation of the retina is ordinarily not difficult, but may be confused by the co-existence of the two conditions, choroidal detachment being the primary lesion. However, a review of the literature indicates that retinal separation complicating choroidal detachment is extremely rare. As an aid to correct diagnosis, the sign of ophthalmoscopic retro- or para-illumination, diminished or negative in choroidal detachment and exaggerated in serous retinal separation, is described. Anatomic and topographic relations of the vorticosae veins are discussed, and a method

of orthographic projection to show precisely their action in localizing and limiting the size of choroidal detachments is described and illustrated. The veins being closer to the vertical meridian, choroidal detachments are larger and of higher elevation in the temporal and nasal fundus; and in the temporal quadrant, the dome of the detachment may extend to and beyond the visual axis to obscure the macula. Additional observations in a case previously reported as retinal detachment are reported to complete the record and to illustrate points in the differential diagnosis.

23 East Pikes Peak Avenue.

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NOTES, CASES, INSTRUMENTS

RELIEF OF EPISCLERITIS BY HISTAMINE DIPHOSPHATE

EDWIN M. SHEPHERD, M.D.

Charleston, West Virginia

Thinking in terms of counter irritation as a means of finding relief for the pain of episcleritis, my father and I tried histamine diphosphate instilled directly into the eye. I had previously used the drug experimentally in the eye while resident on the eye service at Bellevue Hospital, New York. The immediate relief obtained was far beyond our anticipated results. Looking back, we now believe that the relief afforded is occasioned by the lateral release of pressure on pain fibers exerted by the sharply localized episcleric node. The fairly rapid subsidence of the episcleritis after treatment with histamine may be due to the increased availability of blood produced by the generalized conjunctival flush.

The pain of episcleritis can be relieved for a period of 4 to 24 hours by the instillation of histamine diphosphate (1:1,000) in the conjunctival sac of the involved eye. The relief occurs in from 12 to 45 seconds. The episcleric node loses its tenderness and may be freely palpated. The cornea does not lose any of its sensibility as tested with cotton wool. The duration of relief has varied from 4 to as much as 36 hours. When the pain returns, it is usually mild and can be abolished again in a few seconds by the re-instillation of histamine.

This treatment has been used by my father and me since 1941. In each instance the episcleritis has subsided completely in about three days. We are unable to judge whether or not a recalcitrant episcleritis will yield to this treatment because all cases treated to date have cleared. The number of cases treated (5) is too small to

speak in terms of unqualified success. At least the drug is not harmful to the eye, if properly controlled, and its use will tide the patient over a very painful episode while search is being made for the cause of the episcleritis.

Side reactions thus far encountered in the ocular use of histamine diphosphate (1:1,000) are as follows.

In one case the chemosis was enough to show in the palpebral fissure when the lids were closed. A patch and bland ointment brought a normal conjunctiva in 24 hours. Strong miosis can be produced by repeated instillations even in the presence of atropine mydriasis. In the cases tested there was no undue chemosis. In one case with posterior synechiae from an old iritis which had flared mildly, some of the more medial synechiae ruptured, but the iritis quieted nicely.

Skin sensitivity with typical histamine headache later relieved by desensitization in one case showed no unusual conjunctival chemosis. The conjunctival flush produced could be abolished in a few seconds by a drop of ephedrine sulphate (5 percent). Since thinking of ephedrine as a means of opposing the vascular blush of histamine, we have had no case with sufficient chemosis to test it.

CASE REPORTS

Case 1. A white woman, 45 years of age, reported at the office with her left eye painful for the past 12 hours. Examination showed an episcleric node in the lower temporal quadrant of the eye, exquisitely tender to palpation. The remainder of the examination contributed no pertinent information. Two drops of histamine diphosphate (1:1,000) were instilled. The conjunctiva began to flush in about 12 seconds. There was a stinging sensation and the conjunctiva became

markedly flushed in about 50 seconds. The conjunctiva was slightly chemotic, the pain was entirely gone, and the node could be freely palpated without pain. The eye remained quiet for 18 hours, when it began to pain slightly. The patient returned at the end of 24 hours with moderate pain and histamine was instilled again. The same cycle of stinging and chemosis was repeated with relief of pain. The patient reported that following the first instillation the eye remained red for almost 4 hours and then gradually over another 5 or 6 hours became normal except for the episcleric node which remained congested. At the second visit the node appeared less prominent than the first day and was definitely less tender than before. After the second instillation, the eye became perfectly quiet and the patient failed to report for the general physical survey indicated.

Case 2. A white man, aged 64 years, reported to the office with his right eye painful for two days. Examination showed an episcleric node in the upper temporal quadrant, tender to palpation. Two drops of histamine produced a flush in about 12 seconds and relief in 40 seconds. The chemosis was very slight. Pain returned in about 24 hours, but was so mild that the patient delayed returning until the following day. Histamine again brought relief. A thorough medical examination failed to reveal any source of infection. This attack subsided after the third instillation of histamine. This patient reported back two months later with another episcleric node in the same eye and again in the temporal side. Histamine was used for two days with complete relief.

Case 3. A white man, 25 years of age, an infantryman in the U.S. Army, reported to the hospital with chronic tonsillitis and history of repeated sore throat. Two days after tonsillectomy the right

eye developed an episcleric node on the lower temporal quadrant. Histamine instilled in the eye gave relief for almost six hours. A second dose kept the patient comfortable until the next day. Treatments on each of the two days following gave complete relief. It was felt that the infected tonsils were the source of his trouble in view of his otherwise negative physical examination.

Case 4. A white, 22-year-old infantryman, was wounded in action by mortar fire. One small fragment was imbedded in the episclera of the left eye, temporally, and on admission to our hospital was the center of a tender, red, raised area. The node was plainly visible in depth and contained no pus. The tenderness was characteristically that of an episcleritis. Histamine was instilled with relief in about 45 seconds. Treatment was repeated in about 8 hours. The eye was never, during this time, completely free of pain or tenderness, but so marked was the relief that the use of histamine was continued. This dose was repeated three times the following day and once on the third day. The eye was quiet on the fourth day and the small fragment was removed.

Case 5. A 28-year-old white man reported to my office with a painful left eye of two days' duration. There was a typical episcleric node in the lower temporal quadrant. This was very tender on palpation. Histamine, 4 drops, was instilled. There was relief in 45 seconds which lasted about seven hours. The eye became painful again but not markedly so. Another instillation kept the patient comfortable through the night. The eye was only slightly tender and painful the next morning. Histamine administered once on the second day kept the eye comfortable for 24 hours, and a final dose was then sufficient. This man was referred to an internist for a complete physical check up.

CONCLUSIONS

Histamine diphosphate (1:1,000 solution), when instilled in an eye suffering from episcleritis, will afford immediate and prolonged relief of symptoms without the dangers of local anesthesia. In the cases so far studied it has also led to complete relief from the immediate attack. These are not enough cases to justify calling this treatment an infallible cure. The side reactions noted, miosis and chemosis, indicate the need of sensible caution in using the drug. No strong contraindications have yet been encountered in the local use of histamine diphosphate (1:1,000) in the eye.

1106 Virginia Street (1).

A CORNEOSCLERAL SUTURE*

E. W. DYAR, M.D.
Indianapolis, Indiana

Techniques of securing accurate apposition of the limbal incision by sutures, following cataract extraction, have been many and varied. Ellett's monograph† presented this subject most completely. Subsequent articles have corroborated and amplified his thesis.

One feature of the complications attendant on the removal of the crystalline lens is prolapse of the vitreous. If this hazard could be banished, or minimized, the incidence of successful results would be materially increased. It follows that a measure which effects such an end, has merit. The following plan of corneoscleral suturing has proved worthy in many cases.

An apron conjunctival flap is prepared by baring the corneoscleral junction for the upper one third of its circumference.

*From the Department of Ophthalmology, Indiana University School of Medicine.

† Ellett, E. C. *Archives of Ophthalmology*. March, 1937.

A double-armed silk suture is placed in clear cornea at the 10:30- and again at the 1:30-o'clock positions. Corresponding bites are taken in the sclera, with each of the needles approximately 1 mm. behind the limbus. The edge of the conjunctiva is lifted, and the needles are passed from its

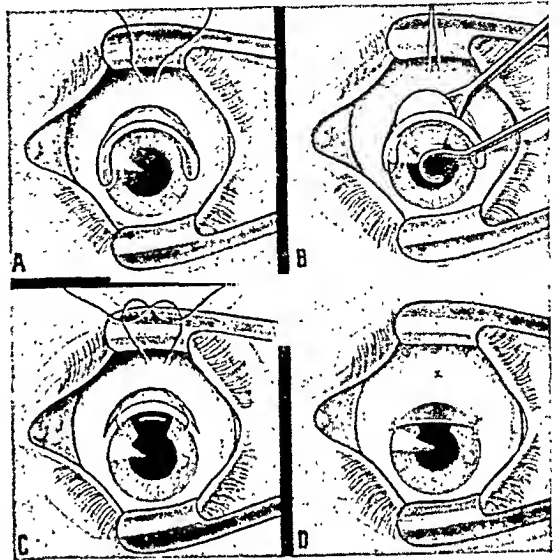


Fig. 1 (Dyar). A, the suture is looped laterally and nasally at the limbus; B, the corneal wound can be brought into apposition by a 4-point support; C, lips of the wound can be separated as desired by releasing traction above; D, the corneal suture is tied above, using a minimum of tension.

under to outer surface, 5 to 8 mm. from the free border. The suture is looped laterally and nasally at the limbus as shown in Figure 1-A, and the section is made by whatever method is desired. The remainder of the operation, up to the actual delivery of the lens, can be accomplished without interference from the sutures.

At the time when the lens presents in the wound, the ends of the suture, which are lying on the brow, are picked up by the assistant and gentle traction commenced. Any amount of aperture of the wound can thus be controlled, depending upon the wishes of the surgeon or the expediency of the moment. It is worthy of

note that, as the last portion of the lens is delivered, the corneal wound can be brought into apposition by a 4-point support (fig. 1-B). The lips of the wound can then be separated as desired for irrigation or repositing of the iris, by releasing traction above (fig. 1-C).

The apron flap is brought into place by fine catgut sutures, and the corneal suture is tied above, using a minimum of tension (fig. 1-D). It has been found that the elasticity of the conjunctiva aids in keeping the suture taut, until a measure of healing of the incision has taken place.

Because of the normally high surface tension of the vitreous, it is fair to assume that a large prolapse of that body cannot easily take place through an opening which has been reduced to a slit or closed. In eyes in which fluidity of the vitreous is anticipated, or known to exist, command of the width of the wound aperture is of significant value.

Sutures placed before the section is made do have the disadvantage of not effecting perfect apposition of the lips of the incision, with the exception of the McLean. It has been found, however, that a second suture can be placed at the 12-o'clock position. For this suture, the McLean principle, the Verhoeff tract, or other techniques, which insure more perfect apposition and aid in reducing postoperative astigmatism, can be employed. A bridle suture has been used in selected cases.

Removal of sutures entails little or no danger, in so far as a reopening of the anterior chamber is concerned. It has been our routine not to attempt removal for at least 10 days. As long as three weeks have elapsed before removal in numerous cases, without excessive reaction. Following anesthesia by several instillations of ½-percent pontocaine, that portion of the suture lying exposed between the two corneal bites is gently teased free with a fine foreign-body spud and is severed

with scissors. The upper cul-de-sac is then exposed with a lid hook. The silk is grasped at the knot with curved dressing forceps and withdrawn through the conjunctiva from above.

23 East Ohio Street (4).

TEAR SAC PROBED THROUGH CANALICULUS OF EVERTED UPPER LID

ELIAS SELINGER, M.D.

Chicago

Passing a lacrimal probe through the upper canaliculus has certain advantages. Once the probe has been successfully introduced through the upper canaliculus, it is easier to pass it into the nasolacrimal duct, since the upper canaliculus forms a more obtuse angle with the tear sac than the lower one, which is practically at a right angle to the sac. When the tip of the probe is passed through the lower canaliculus, it not infrequently assumes a faulty position in the sac as the shaft of the instrument is brought into a vertical position. In infants and small children, the tissues of the canaliculus are so delicate that false passages and strictures of the canaliculus may result from the trauma incident to faulty technique in passing the probe. Such an occurrence is particularly unfortunate in the lower canaliculus. Since the lower canaliculi play the major part in tear conduction, strictures here result in permanent epiphora. A stricture of the upper canaliculus usually does not lead to interference with the conduction of tears into the lacrimal sac.

One reason for the comparatively infrequent use of the upper canaliculus for passage of the lacrimal probe is the awkward approach due to the position of the punctum and the canaliculus. This makes it necessary to work from below upward.

This difficulty can be easily overcome if the upper lid is everted and held in that position while the punctum and canaliculus are being dilated and while the lacrimal probe is being passed (figs. 1 and 2). Frequently, one can permit the lateral two thirds of the upper lid to fall back into its natural position during the manip-



Fig. 1 (Selinger). Upper punctum being dilated while lid is everted.

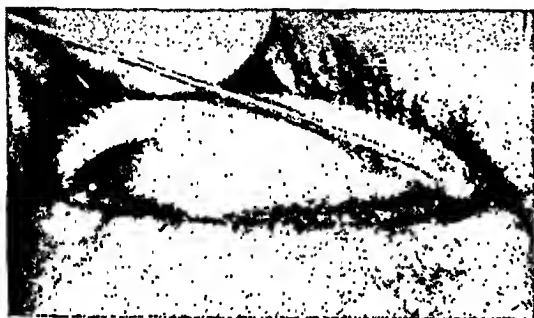


Fig. 2 (Selinger). Bowman probe in canaliculus of everted upper lid.

ulation, while keeping the medial one third everted. I have seen no reference in the literature to this technique of probing through the upper canaliculus. I have been using it on adults, as well as on children and infants, for the past three years.

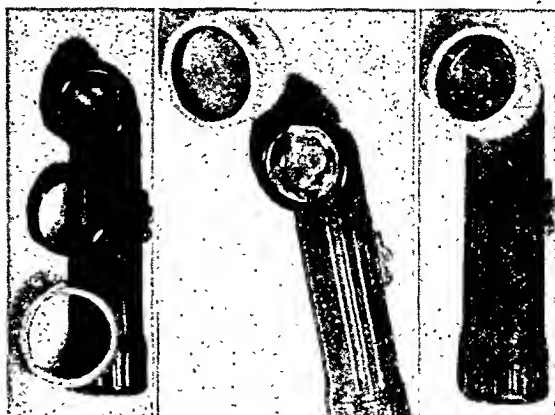
104 South Michigan Avenue (3).

A FOCUSING FLASHLIGHT

I. HERBERT KATZ, M.D.
Syracuse, New York

This focusing light consists of an ordinary large flashlight, a +13.00D. lens, and a holder for the lens (fig. 1).

As illustrated, the flashlight is an army



Figs. 1, 2, and 3 (Katz). A focusing flashlight with the parts separated and assembled.

type (TL 122-B), with a focusing bulb and a plano glass for protection. The bulb focuses at one foot or more and is labeled Tungsol, PR6, 2.5 volts.

The lens, for sale by optical supply houses, is 40 mm. in diameter and is encased in a black plastic rim, the outside diameter of which is 47 mm. The holder is made of acrylic of a size to hold the lens snugly on the flashlight and with a small incurved rim to prevent the lens from falling out (fig. 2). This is the only part of the apparatus that has to be made to order. The one illustrated was made by the dental department of an army hospital.

This illuminating system gives a brilliant 5-mm. spot and focuses at 65 mm., almost regardless of type of bulb. Incidentally, there is considerable variation in the brightness of different bulbs with the same batteries.

The advantages of this light in the study of the anterior segment are its brilliant spot focus, portability, long battery life, and freedom from adjustments, entangling wires, and so forth. It will be found particularly useful in clinics, at the bedside, and where large numbers of patients are to be examined. In the army, it was also useful and satisfactory for intraocular surgery.

713 East Genesee Street.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

October 7, 1946

DR. BENJAMIN FRIEDMAN, *presiding*

PROVOCATIVE TESTS IN GLAUCOMA

DR. SYLVAN BLOOMFIELD discussed this subject during the instructional hour, see this JOURNAL, page 869.

NEW TEST FOR DARK ADAPTATION

DR. HOWARD AGATSTON stated that testing of the light sense is an important aid in diagnosis, but it has always been a laboratory rather than a clinical procedure. The test combines two techniques, namely bleaching of the retina and perimetry in dim illumination. It measures the course of dark adaptation of the central 60 degrees of retina after preexposure to bright light.

A preliminary visual field is taken on a tangent screen, equipped with a central, red fixation light. A 2-mm. white test object is used at one meter and the extent of the field along the 45-degree, 135-degree, 225-degree, and 315-degree meridians is recorded. The eye is then exposed to the light of an X-ray shadow box for five minutes, and the visual field in dim illumination is plotted at one-minute intervals along any one or more of the meridians mentioned. The only source of illumination is a 15-watt incandescent bulb in a reflector. Its distance from the tangent screen and the angle of the beam (indirect lighting) are adjusted until a normal dark-adapted eye has a 22-degree to 30-degree field with a 2-mm. test object at one meter. This lighting is less than one foot-candle and, therefore, the

eye is used as the photometer. He discussed standardization, normal curves, and interpretation of the curves.

Discussion. Dr. J. Mandelbaum said that the intensity of the light reflected from Dr. Agatston's test objects has not been standardized quantitatively. Judging from his description, the intensity is probably about 0.1 millilambert. At this intensity level, both the cone and the rod cells function normally. He believes that Dr. Agatston's test records the recovery of rod function as well as cone function, after exposure to bright light. It has been demonstrated by Hecht and others that dark adaptation of the cone cells proceeds much more rapidly than it does for the rod cells. The initial latent period before the test object appears at the fixation point for the normal eye represents the time required for the foveal cones to adapt to the level where the approximately 0.1-millilambert stimulus becomes visible. Only after rod adaptation is well under way does the stimulus become evident further peripherally, such as at 20 degrees.

Diminished cone function should be characterized by an increase in the initial latent period. Diminished rod function would be indicated by a recovery curve, whose slope is reduced, so that peripheral recovery takes a disproportionately long time. In order, however, to procure really precise evidence concerning the cone and rod function, more complex apparatus is required. The light-sense test, which would best suit the purposes of clinical ophthalmology, is that devised by Louise L. Sloan. It consists of a light source mounted in a box, that can be attached to the arm of a perimeter and can, therefore, be used to test any

desired retinal area. In front of the light is suspended a photometric wedge and neutral filters to cut down the light intensity. However, until instruments of this kind become available and are put in general use, tests such as devised by Dr. Agatston will be very useful.

Dr. I. Givner asked whether this method would not be of much use in diagnosing an early detachment of the retina which could not otherwise be seen.

Dr. Agatston (in closing) said that the Sloan perimeter with the illuminated test object has in the past been used to measure the light threshold of various points of the retina. The light and/or form stimulus is reduced from minute to minute. In the visual field recovery test, during the period of adaptation, the stimulus remains fixed. However, Sloan's apparatus, if available, could easily be used to make the test. In reply to Dr. Givner's question, Dr. Agatston stated that in retinal detachment a visual-field defect is usually exaggerated in dim illumination. The rate of dark adaptation of the retina near the area of the detachment would undoubtedly be prolonged. This test uncovers the area of depressed retinal function not disclosed by ophthalmoscopy or dark-room perimetry.

AIR INJECTIONS IN TENON'S CAPSULE FOR LOCATING FOREIGN BODIES

DR. BENJAMIN FRIEDMAN stated that multiple foreign bodies in the globe, orbit and adjacent tissues cannot be localized and differentiated easily by the standard two-plane X-ray exposures. Air is injected into Tenon's capsule and stereoplates are taken with the head in a modified Water's position. The globe is outlined by a pocket of air, and its relation to the foreign body is studied in the stereoviewer. About 6 to 10 cc. of air are injected. There is an average proptosis of the globe of 2 to 3 mm., and

there is an increase in the intraocular pressure of 8 to 10 mm. Hg (Schiotz). This method is contraindicated in cases of recent perforations of the globe; extrusion of some of the ocular contents might result from the increased pressure. Bone-free dental films of the anterior globe segment may be made while the eye is proptosed.

Discussion. Dr. Joseph I. Pascal asked whether Dr. Friedman had had any experience with the Berman localizer. Dr. Friedman replied that he had not, since this instrument had not been made available to him in the Armed Forces.

ABNORMAL RETINAL CORRESPONDENCE

DR. E. KRIMSKY said that a squint may manifest normal or abnormal retinal correspondence, or the combination. Abnormal retinal correspondence is a latent suppressed tendency on the part of a squinting eye to emulate binocular fixation or projection in association with the fellow fixing eye. This is true even though the corneal light reflex be displaced from the fixational position in the deviating eye.

The displacement of the corneal light reflex from the fixational position suggests squint. Estimation of the deviation on mere inspection by the Hirschberg method is crude and inaccurate. An accurate measurement of ocular deviation is a necessary preliminary prerequisite to the study of retinal correspondence.

The artificial restoration of the displaced corneal light reflex to a fixational position is a dependable method both in the measurement of squint and in the diagnosis of retinal correspondence. Such restoration may be accompanied by the simple prism-reflex test. Additional methods include the photometric stereoscope, the synoptophore, or the anglo-meter.

Discussion. Dr. A. Linksz said that

he agreed with Dr. Krinsky's statement, that the production of identical images on so-called corresponding retinal points is not in itself retinal correspondence. Fusion in the high brain centers is an essential part of the phenomenon called normal retinal correspondence. In practice, the determination of common visual directions of the two foveas is used as an indication of normal retinal correspondence.

The double-image test of Bielschowsky, Tschermak's after-image test, the superimposition of a bird and a cage in the synoptophore are all tests for the determination of common visual direction and not of correspondence. Since the same tests are used in general for the determination of what is called abnormal retinal correspondence. Dr. Linksz emphasized the fact that these tests do not prove fusion, and thus do not prove the presence of retinal correspondence. The fact that, in certain squints, the fovea of one eye and an area other than the fovea in the squinting eye assume common visual direction cannot be denied. However, it has not been proved and Dr. Krinsky has not submitted any evidence to support the assumption that these two areas actually contribute to a fused mental image. Dr. Krinsky has, therefore, failed to prove the existence of an anomalous retinal correspondence.

Dr. Krinsky (in closing) said that the best way to determine abnormal retinal correspondence is with the aid of satisfactory artificial illumination, which enables one to observe the corneal light reflex. Such illumination can be employed with the prism-reflex test, the photometric stereoscope, the synoptophore, or the angiometer.

There are some who do not recognize the existence of fusion in abnormal retinal correspondence. If one thinks of fusion in terms of critical binocular fixa-

tion, then that would be correct. However, there are different degrees of fusion and the type found with abnormal retinal correspondence is a rudimentary macular-paramacular type associated with some relative suppression in the area of such correspondence.

Bernard Kronenberg,
Secretary

CHICAGO OPHTHALMOLOGICAL SOCIETY

May 20, 1946

PETER C. KRONFELD, *president*

CLINICAL PROGRAM

(Presented by the Staff of Children's
Memorial Hospital.)

MICROPHTHALMOS WITH CYST

DR. RICHARD C. GAMBLE presented a male infant who was first seen in May, 1945, when four months of age. The right eye was very small and turned upward. It was well formed and had no coloboma of the iris. No coloboma of the choroid could be seen, but fundus examination, even under anesthesia, was difficult. There was a purplish swelling of the temporal half of the lower lid, about 15 mm. in diameter. The left eye was normal externally but had a small coloboma of the choroid below the disc.

On June 1st, the cyst was aspirated through the skin of the lower lid and 3 cc. of thin yellow fluid were removed. The swelling disappeared at once and the eyeball came down to a normal position. The cyst was aspirated in this manner every few weeks until October 18th, at which time the eyeball and the cyst were removed. So far as could be determined there was no communication between the

interior of the eye and the cyst. Methylen blue was injected into the cyst which aided considerably in its removal, inasmuch as the wall was very thin and it was difficult to differentiate it from the other tissues. The cyst has not returned since the operation.

PTOSIS WITH NEUROFIBROMA OF UPPER LID

DR. RICHARD C. GAMBLE said that this five-year-old girl was born with the right upper lid drooping and thickened. She had café-au-lait spots on the body. X-ray studies of the optic canals were negative. She had had four applications of radium to the lid with a moderately good result. There was marked anisometropia. Vision, with correction, was: R.E., with a $-8.00D.$ sph. $\ominus -150D.$ cyl. ax. 170° , 15/200; L.E., $-2.00D.$ cyl. ax. 165° , 20/30. Discs were normal. She had worn a ptosis crutch since February, 1944, but vision was still poor in the right eye.

PTOSIS AND POSSIBLE NEUROFIBROMATOSIS OF EYELID

DR. RICHARD C. GAMBLE presented a girl, aged six years, who was first seen in January, 1945. The right eye was normal. The left upper lid had drooped since she was two years of age and was swollen and boggy. The left superior rectus muscle was paretic. A café-au-lait spot was present on the back. X-ray studies of the optic canals were negative. A ptosis operation was not advised because it was thought that the upper lid might develop more evidence of neurofibromatosis. So far this has not occurred. The condition at present is essentially as it was one year ago.

METALLIC FOREIGN BODY IN VITREOUS

DR. RICHARD C. GAMBLE said that this 12-year-old boy sustained an injury to the left eye when he exploded a dynamite

cap on August 25, 1945. He was first seen on September 10, 1945. The right eye was normal and had 20/15 vision. The left eye had 20/50 vision. There was a scar in the cornea near the limbus at the 3-o'clock position, the iris root was torn at this point, and there was a slight lens opacity. A shiny, metallic-appearing foreign body was present in the vitreous, down and temporalward. X-ray pictures showed several dozen small foreign bodies scattered through the face.

At present, vision in the left eye is 20/15. There is a slight greenish haze in the anterior lens capsule, but there is no evidence of any inflammation about the foreign body in the vitreous.

SYMPATHETIC OPHTHALMIA

DR. RICHARD C. GAMBLE said that this 39-year-old man received a severe contusion of the left eye on November 19, 1945. There was a rupture of the sclera above the cornea which was covered by conjunctiva. The anterior chamber was filled with blood. The lens was under the conjunctiva on the nasal side of the cornea. Since the lens had not absorbed, it was removed on December 4th through a small incision in the conjunctiva. Penicillin was given for a week immediately after the injury. The left eye was in relatively good condition by January 9, 1946, and very little congestion was present. Vision was: R.E., 20/15; L.E., 20/200. The right eye showed slight ciliary congestion, the pupil was small, vision was still 20/15. No precipitates were seen in the cornea. Sulfathiazole was ordered, and on January 25th the left eye was enucleated. Microscopic sections showed typical sympathetic ophthalmia.

The pupil of the right eye did not dilate well with atropine, but dilated widely with 10-percent neosynephrin, and the dilatation was maintained by atropine. Penicillin and sulfathiazole were used, but the

latter had to be discontinued because of fever and rash. At the present time the vision in the right eye is 20/15. There are a few precipitates in the cornea, the iris is mobile, the media are clear, and there is very little congestion.

TREATMENT OF AMBLYOPIA EX ANOPIA

DR. W. SEGALL presented several successfully treated cases and explained the method now used at Children's Memorial Hospital in treatment of these cases. Coöperation of parents and children is essential. Amblyopia ex anopsia is not the result of an anatomic defect in visual structures, but has a physiologic etiology. The affected eye is retarded in its function but, up to a certain age, can be brought to normal or practically so. After the eighth year, the chances for improvement are usually slim, although occasionally, under proper supervision, vision in a 10-year-old child has been improved.

Routine examinations are given. These include a vision test, if possible; examination of the external eye, eye movements, the squint, the media, and the fundus; and atropine refraction and the prescribing of glasses. If the vision cannot be tested, the squinting eye should be treated as an amblyopic eye, especially if it stays in eccentric fixation and if the squint is monocular. The near-vision test seems to have some prognostic value. Improvement in near vision is noticed earlier than in distant vision. If both near and distant vision remain equally poor, the prognosis is not favorable. Covering is most important, and constant covering appears to be the most effective treatment.

While treatment in the out-patient department was only partly successful in a number of cases, attendance at sight-saving classes brought striking results in

a relatively short time. This may be because proper supervision is given in the schools and is not given at home. The close work given at school, in properly illuminated classrooms and with proper teaching equipment, is especially useful. If the sight-saving classes were started at the kindergarten age, the number of successfully treated cases would undoubtedly increase.

As a rule, children tolerate the cover well if vision improves quickly. The eye is kept covered for as long a time as benefit can be noted. After the desired result is obtained, the cover is worn part time for a certain length of time. Sudden interruption in the wearing of the cover may reverse the good results achieved. The full correction given in all cases has a good effect on the squint, but the amblyopia persists. The disappearance of squint sometimes leads the parents to believe the child has been cured. If treatment is not continued, however, vision in the squinting eye usually deteriorates. Covering the good eye, with full correction in the poor eye, has been advised with the idea of treating both conditions at the same time. However, it seems most important first to correct the amblyopia by constant cover, and then to take care of the squint later. The good eye is watched carefully to guard against development of amblyopia. Children attending sight-saving classes are examined every two months, younger children much oftener.

SCIENTIFIC PROGRAM

WILLIAM S. GRAY (by invitation) gave a paper on "The Reading Problem," and JOSEPH TIFFIN (by invitation) spoke on "Some Visual Problems of Modern Industry."

Richard C. Gamble,
Secretary.

NEW ENGLAND
OPHTHALMOLOGICAL
SOCIETY

April 16, 1946

DR. HOWARD F. HILL, *presiding*STUDIES ON EXPERIMENTAL EXOPHTHAL-
MOS

DR. GEORGE K. SMELSER read an interesting paper on the above subject. Dr. Smelser said that the cause of clinical hyperthyroidism and its accompanying exophthalmos had not been proved but that the anterior hypophysis was suspected, because administration of extracts of this gland to animals reproduced all of the characteristics of the disease. There is much evidence that the thyroid is not the cause of the exophthalmos; for example, in a large proportion of cases thyroidectomy does not cure but aggravates the ocular symptoms. Exophthalmos of this sort is also much more easily produced in thyroidectomized animals than in those in which the thyroid is intact. Furthermore, thyroxin administration inhibits the production of exophthalmos. The sympathetic nervous system and smooth musculature of the lid and orbit, which undoubtedly affect the width of the palpebral fissure in the hyperthyroid patient, are not responsible for the exophthalmos caused by pituitary injections. The protrusion of the eye is due to swelling of the retrobulbar tissues. Both the orbital fat and the extraocular muscles are edematous, and the edema fluid contains considerable protein. The histologic condition of these tissues is extremely similar to that seen in human cases of postthyroidectomy exophthalmos. Analysis of these tissues in experimental animals showed that in exophthalmos the lipid content of the fat tissue

was unchanged and that the increase in the weight was due to water and connective tissue. The increase in muscle weight was also due to its water content, although there was some true muscle hypertrophy involved.

There are four major facts which may be involved in edema formation. Of these, the last two may be operable in exophthalmos. (1) Any increase in capillary pressure is probably offset by the increase in orbital-tissue pressure which occurs in exophthalmos. (2) There is no evidence of a decrease in the osmotic pressure of the blood (protein content) in exophthalmic animals or human beings. (3) Possibly the edema occurs because the permeability of the capillaries of the orbital fat becomes increased. Preliminary experiments with dyes and the protein content of the edema fluid suggest this possibility. (4) The drainage of interstitial fluid is poor in the orbit, for lymphatics are apparently lacking in this region. These last two factors seemed to be responsible for the edema and to be the cause of exophthalmos.

The edema may be the cause of more than just the swelling of the orbital contents for the circulation of blood in edematous tissues is impaired. This probably makes less oxygen available. The oxygen consumption of the eye muscle is very great and, furthermore, does not decrease appreciably following thyroidectomy. It seems possible, therefore, that the eye muscles in exophthalmos are handicapped by a relatively meager oxygen supply which would be reflected by their poorer function, an observable clinical fact. This weakness of the eye muscles would tend, in turn, to increase the exophthalmos secondarily.

Dr. Mahlon T. Easton,
Reporter.

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THE SPRING MEETINGS, 1947

The American Ophthalmological Society held its 83rd annual meeting on June 5th, 6th, and 7th, at its favorite site, the Homestead, Hot Springs, Virginia. There were 113 members and 33 guests registered. Sir Stewart and Lady Duke-Elder from London were also present and renewed American friendships of previous years.

As usual, the program was varied; 23 papers were read and were actively dis-

cussed. It is always difficult to single out the most outstanding papers on the program of this Society, but that of Dr. Gordon M. Bruce on "Eye Changes in Pheochromocytoma of the Adrenal Gland" was ably presented and novel. Dr. A. B. Reese's paper on "The Significance of the Base Pressure in Primary Glaucoma" contained the interesting conception that the base pressure in this disease should be one of the criteria upon which should rest the decision of the type of operation re-

quired. The remainder of the program was good, and several other papers are noteworthy.

Dr. Henry C. Haden was elected president, and Dr. Bernard Samuels, vice-president. A particularly happy event of the meeting was the bestowal of the Society's highest honor, the Howe Medal, upon Dr. Lawrence T. Post, consulting editor of the JOURNAL, for distinguished service to ophthalmology. The Society voted to hold its 1948 meeting at Hot Springs, and the date will be announced later.

On Tuesday, June 10th, the Association for Research in Ophthalmology held its 16th annual meeting at Atlantic City. There was excellent attendance, and one of the best of the Association's programs was presented. Instead of the usual 10 papers, 12 papers were read, all of them of much scientific interest and value. The papers by V. Everett Kinsey on "The Transfer of Ascorbic Acid and Related Compounds Across the Blood-Aqueous Barrier" and that by Dr. Alson E. Braley on "Virus Studies in Lymphomatoid Disease of the Ocular Adnexa" were particularly worthy of attention.

A silver bowl, suitably inscribed, was presented by the Association, through Dr. Walter B. Lancaster, to Dr. Conrad Berens in appreciation of his great service in founding the Association. Dr. Phillips Thygeson is the next chairman and Dr. Brittain Payne the new trustee. Dr. James Allen was elected secretary-treasurer.

The Section on Ophthalmology, American Medical Association, joined in the centennial celebration of the parent organization in Atlantic City, in a delightful and friendly session. Sir Stewart Duke-Elder was the Foreign Guest of Honor, delivering a superb address on the "Nature of Intraocular Fluids." Dr.

Frederick Verhoeff, the American Guest of Honor, gave the centennial address of the section on "American Ophthalmology During the Past 100 Years," in which he developed the historic stages of progress of our great specialty, detailing events and personages in his usual entertaining fashion. The chairman of the Section, Dr. Derrick Vail, gave as the subject of his address, "The Prestige of Ophthalmology."

Besides these special addresses, 14 scientific papers with excellent discussions were read. The quality of the program was outstanding, and each of the presentations was noteworthy. An exceptionally large number of the Fellows and members of the section were present. There were also other distinguished foreign guests present, among them Professor Arganaraz of Buenos Aires, Argentina, and Dr. Tomas Yanes of Havana, Cuba. The scientific exhibits of the Section received much favorable comment.

Sir Stewart Duke-Elder received the Research Medal of the Association for his outstanding scientific and literary researches of great value to patient and physician. That it was an exceedingly popular choice of a recipient of this great honor, was shown by the sustained and spontaneous applause by those present.

The newly elected officers of the Section are: Dr. Everett Goar, chairman; Dr. Francis H. Adler, vice-chairman; and Dr. Trygve Gundersen, secretary.

The Atlantic City meetings were saddened by the sudden death of our colleague and friend of each one of us in American Ophthalmology, Dr. Edward C. Ellett of Memphis, Tennessee, who died of coronary occlusion on his arrival at Atlantic City on June 8th. None of those who were with him in Hot Springs and heard his vigorous discussions of several of the papers there, had the slightest idea

that he would be taken from our midst so soon and so abruptly. His loss to American ophthalmology is a very great and severe blow, and we mourn grievously.

Derrick Vail.

EYE BANKS

It is time to "Stop, Look, and Listen," to evaluate keratoplasty, and to consider the tremendous publicity that has recently surrounded the subject.

After the report of one failure of corneal transplant over 100 years ago and one success about 50 years ago, the subject lay dormant until its resurrection some 35 years later. At that time, several investigators became interested anew and, applying modern techniques, began to have some successes. Shortly thereafter this dramatic idea reached reporters who seized on it and publicized it avidly. Uncritical as most people are in fields other than their own, seeing a gold mine wherever one nugget is uncovered, corneal transplant meant to them an eye for an eye, a good one for a bad, and hope stirred in the mind of every blind man. Philanthropic individuals and organized charity were quickly aligned to be of service but the laity has almost taken over.

Firstly, what is the probable number of those who might be helped by corneal transplants? The estimates in the press varying from 10,000 to 40,000 surely paint a greatly exaggerated picture. A recent letter from one eye bank suggests that 15,000 of the 250,000 blind in this country would be benefited by keratoplasty. Can this possibly be true? Apropos of this, a careful survey of pupils in the St. Louis School for the Blind recently did not reveal a single case. A review of those on the pension rolls for the blind in Missouri has also apparently been fruitless. The operation itself is not extremely

difficult. Any competent eye surgeon should be able to perform it and many eye surgeons have stood ready and waiting for suitable cases but, for the most part, the cases haven't appeared. Only a few hundred corneal transplants have been performed in the United States and already there are indications that the first crop has been harvested.

Of the operations thus far performed, perhaps somewhat because of inexperience and a desire to improve technique and to learn just what cases were amenable to betterment, many have proved futile and some definitely ill advised. Actually, we may ask what percentage of them showed significant value to the patient. The answer is not known, but from conversation with some of those most active in this kind of work, 25 percent would be a generous estimate. Frankly, therefore, we are dealing with a very restricted field, although important to the individual affected, and one that should undoubtedly be investigated but need not be overemphasized. Nothing herein written is intended to belittle or detract from the studies being made to improve techniques or the efforts to train ophthalmologists to perform keratoplasties. Both are highly desirable and their encouragement is a valuable contribution to the advancement of knowledge and the general welfare. These efforts should be continued and by no means discouraged.

Obviously, donor eyes are needed. How can they be best obtained? The idea of eye banks occurred to someone, based perhaps on the invaluable blood banks brought so keenly to the attention of the public during the recent war. Let us consider for a moment possible sources and handling of donor material. Unquestionably, present methods may and probably will be improved but, as of the moment, the best material is fresh eyes or those

after removal not more than three days previously. Then, too, the eyes obtained from cadavers must be enucleated within a few hours after death and be placed in a container at a few degrees above zero (centigrade) and shipped to the surgeon. The function of the eye bank is to interest possible donors and to store and distribute material. Actually, how do banks function? Almost every reader has heard about eye banks so that those in charge of them receive many inquiries as to how one may leave his eye for scientific purposes. Forms are sent to inquirers advising them how to act but between that and the accomplishment of their purpose lie not only the continued life of the individual but the physician attending at the time of death who must immediately enucleate the eyes, the lawyer who must be aware of the request in the will, the undertaker who is usually very unsympathetic to the idea because it makes injection more difficult, and the nearest of kin who legally controls the disposition of the body. Then, too, suitable containers for the eyes and methods of transport are difficult to obtain unless one has made advance preparation for the event, so the net result from such inquiries is close to zero. However, eye-bank organizations in a few large cities have been successful in serving as intermediaries in getting enucleated eyes for transplant purposes.

Probably the best way is to have available forms of bequest to which the attention of each patient entering the hospital is drawn in the hope that he or she will donate his or her eyes in case of death in the hospital. An ophthalmological staff that has been advised of how to act in case of death of these patients, how to enucleate, and how to block the orbits so that the injection fluid will not seep out, and that has made an arrangement in advance with the undertaker, can then

occasionally obtain transplant material. By this method also more valuable eyes for pathologic examinations may be obtained. And this is a most important point because it may help solve the always difficult problem of getting eyes of deceased patients, whose cases have been interesting, for pathologic study. Indeed, a little over-publicity of corneal grafts might be excused to accomplish this good purpose.

One should applaud the efforts of organizations to obtain material for transplants, but these organizations should attempt to make the public aware of the true situation and should not indulge in gross exaggerations. The publicity has been so great and some of it so ill considered as often to hold out hope where there is no hope. By constant use of newspapers, magazines, and radio talks the procedure has been over publicized and is making the whole matter ridiculous in the eyes of the profession.

Among the latest outbursts on the subject is one by a proposed new organization addressed to some 18 well-known ophthalmologists who have been selected as surgeons capable of performing this "delicate operation of corneal transplantation." It goes on to state that "Preparations have been made for many nationwide broadcasts to select blind patients to be operated upon as outlined in the enclosed letter being mailed to specialists in over 500 cities. The radio editors request that for this first program we shall interview on the air someone who has had his or her sight restored and then allow that person to select the next patient with all expenses guaranteed.

"To say that your coöperation is desirable is a magnificent understatement. Each of you in your own city is the very life blood of the ——— (name of organization deleted by this writer). Without you we simply cannot exist. You are the

only ones who can perform the operation. We believe our objective is one of the most noble ever attempted. If we are to survive, we must request from you the performance of two minor duties: First—Personally seek out and urge every person you know who has had their sight restored to write an interesting story about themselves to our radio editors. The surgeon's name will not be publicized. The winner will receive a wonderful trip to New York City. Second—Examine and screen out the blind in your city to obtain possible future patients for our sponsors. It is preferable that each person be examined by at least three specialists.

"Radio time has been offered to us but it must be accepted immediately. Therefore, it is most urgent that your replies be received as soon as possible. Please offer suggestions of possible additions to our list of surgeons who perform this specialized operation. Your confidence will be respected. In closing may we respectfully suggest that several thousand patients divided among the small but very exclusive group of surgeons will bring not only personal pride of achievement but considerable revenue to each surgeon as well."

The intent behind this letter may be of the best but certainly the professional advice is not such as to inspire confidence.

There is also an "open" letter accompanying the above that is much too long to quote. The financing of the surgical expense of these patients is to be solicited from 150 of America's leading advertisers.

A comprehensive symposium on keratoplasty is to be held at the meeting of the American Academy of Ophthalmology and Otolaryngology in Chicago in October and it is to be hoped that we shall learn much more about the entire subject. Let us have "The truth, the whole truth, and nothing but the truth."

Lawrence T. Post.

THE BICENTENNIAL OF CATARACT EXTRACTION

On April 8, 1747, Jacques Daviel called to operate on M. Garion, a master wig-maker, whose cataracts appeared very favorable for surgery. Nevertheless, the expert Daviel was unable to depress either lens. At that moment he decided on a deliberate extraction. After widely opening the right cornea, he passed a small spatula through the pupil and extracted from the posterior chamber the entire lens, the capsule of which had been divided by his previous interventions. Though some vitreous was lost, the patient made an uneventful recovery; and with a cataract glass read accurately. Thus was initiated the first significant advance in cataract surgery since the invention of couching by the legendary Susruta sometime about 1000 B.C.

Accustoming himself gradually to the new operation, Daviel came to the firm decision three years later to operate for cataract only by extraction. Of a total of 240 extractions, Daviel classified 33 as failures, but the standard of success then current included all whose postoperative vision allowed walking without a guide. In his claim for priority, Daviel stressed that the idea of extraction logically followed an appreciation of the true nature of cataract, a concept which was accepted only after Brisseau's demonstration in 1705. The lens had been previously assumed to be the seat of vision, hence the scriptural expression "precious as the apple of the eye." After Daviel's communication, his formidable operation was further popularized by Baron Wenzel who admitted destroying a hatful of eyes before achieving the requisite skill. Success demanded of the surgeon "a lady's hand, an eagle's eye, and a lion's heart."

In the century that followed the pros and cons of couching and extraction were ardently debated as each procedure was

somewhat improved. In 1772, Percival Pott, a proponent of couching, gained from his experience the conception of discission as a distinctive method of dealing with soft cataracts, and Saunders, 30 years later, demonstrated its special value in operating on children. Von Willburg, in 1785, gave couching a new lease of life by changing the maneuver from depression to reclination.

A hundred years ago, although extraction was gaining favor in Europe, reclination was still preferred in this country, being advocated by Edward Delafield, a founder of the New York Eye and Ear Infirmary, as the more successful procedure—a view strongly shared by his famous contemporary, Argyll Robertson, and many others. Some conservative surgeons attempted to avoid the evils of depression and the dangers of extraction by performing repeated discissions in most cataracts—Jacobs up to the age of 50 years, and Stevenson even included in his report a woman, aged 91 years.

At this impasse, von Graefe, whose skill and insight were universally acknowledged, pondered on improvements of technique that would make the Daviel operation less hazardous. The result was his peripheral linear section. His stimulating contributions intensified the interest in extraction, and secured its definitive acceptance even before the advent of asepsis and local anesthesia removed the dangers that von Graefe had sought to circumvent. Indeed, his innovations, except for the von Graefe knife, were finally abandoned.

From the time of Daviel the safe intracapsular removal of the cataractous lens has been the dream of the ophthalmic surgeon. The reckless technique of the

Pagenstechers won few disciples, but increasing popularity came with the methods of Smith, Barraquer, and Stan-culeanu. Finally the introduction of various safety measures including akinesia, superior rectus control, corneoscleral sutures, and retrobulbar anesthesia, coupled with the enthusiastic sponsorship of Knapp, Elschmig, Grosz, Sinclair, Arruga, and Manes, at long last established the intracapsular operation as the generally preferred procedure of modern cataract surgery.

Fifty years ago Herman Knapp in an analysis of a large series of cataract expressions by qualified operators found that 85 percent of the results were successful, his standard being postoperative vision of 20/200 or better. In 1,000 intracapsular extractions reported in 1944, again 85 percent were considered successful, but the standard now was a postoperative vision of 20/30 or better. In 5 percent of the cases, vision was annihilated through postoperative complications—hemorrhage, iritis, vitreous loss, corneal dystrophy, glaucoma, retinal detachment, and in one case, infection. Beneventus Grassus in his *Practica Oculorum*, the first incunabula on the eye, began and ended his operations with a prayer. In the silence of his soul what surgeon of today dare do otherwise!

Only slowly has ophthalmology realized its measure of indebtedness to Daviel. His grave is in the cemetery of the Grand Saxonix Church, two miles north of Geneva, Switzerland, but not until 1885 was a suitable memorial placed at this shrine.

James E. Lebensohn.

OBITUARY

WALTER IVAN LILLIE
(1891-1947)

When Walter Ivan Lillie died suddenly of a heart attack at his home on February 21, 1947, the medical profession lost one of its best known and most respected ophthalmologists.



DR. WALTER IVAN LILLIE

(Photograph © Fabian Bachrach.)

Born on November 5, 1891, in Grand Haven, Michigan, Dr. Lillie was the third of four sons of Walter Irving Lillie and Ella McGrath Lillie. After his graduation from the Grand Haven High School in 1909 he entered the University of Michigan from which he received the degree of Doctor of Medicine in 1915. He interned at the University Hospital, Ann Arbor, Michigan, and from there went to the Buick Emergency Hospital, Flint, Michigan.

Walter Ivan Lillie became a fellow in ophthalmology on the Mayo Foundation on July 1, 1917, and was made assistant in ophthalmology in the Mayo Clinic. On August 11, 1917, he volunteered for military service and was assigned to active duty for a six weeks' course at the Psychopathic Hospital in Ann Arbor. On September 29, 1917, he was appointed examiner in neurology and psychiatry at Base Hospital with the 37th Division, Camp Sheridan, Montgomery, Alabama. On February 14, 1918, he was attached to the British Army in England. There he took care of shell-shocked cases in the 4th London General Hospital, British Expeditionary Forces. On April 29, 1918, he was made assistant division psychiatrist with the 41st Division, American Expeditionary Forces, St. Aigmon. He continued in the neuropsychiatric service of the American Expeditionary Forces at the First Depot Division and Base Hospital 117. Beginning February 4, 1919, he conducted examinations of command for mental and nervous diseases at Camp Meigs until he was separated from the service on March 10, 1919. After his release from the Army he resumed his fellowship on the Mayo Foundation and received the Master's Degree in Ophthalmology in 1922. He was made an instructor in ophthalmology on the staff of the Graduate Medical School in the Mayo Clinic and by 1927 had been advanced to associate professor of ophthalmology on the Mayo Foundation.

In November, 1931, Dr. Lillie traveled to Shikarpur, India, to serve with Dr. H. T. Holland at his large ophthalmic surgical clinic for a two-month period. After his return by way of the Orient in March, 1932, he continued his work at the Mayo Clinic.

Dr. Lillie was appointed professor of ophthalmology and head of the depart-

ment at Temple University School of Medicine in September, 1933. He became consulting ophthalmologist at Temple University Hospital and Shriners Hospital, Philadelphia, and at Norristown State Hospital, Norristown, Pennsylvania; and guest lecturer in neuro-ophthalmology, Graduate School, University of Pennsylvania.

On August 30, 1916, Dr. Lillie married Miss Opal C. Jones at St. Johns, Michigan, who with one son, Robert J. Lillie, survives him. Philip M. Lillie, a second son, served in the Army Air Forces and was killed on a training flight on July 31, 1944. Dr. Lillie is also survived by a granddaughter and three brothers.

Dr. Lillie was a member of the American Medical Association, the American Academy of Ophthalmology and Otolaryngology, the American Ophthalmological Society, the American College of Surgeons, the Philadelphia College of Physicians, Sydenham Medical Coterie, the Harvey Cushing Society, and Sigma Xi. He was a regular attendant at the meetings of the medical societies, both local and national, of which he was a member.

Whenever Dr. Lillie appeared on a program, he made an outstanding contribution, not only because of his unquestioned authority and ability, but also because of his direct approach and enthusiastic presentation. Although his national reputation was primarily based on his presentations of neuro-ophthalmic subjects, he was equally capable in the fields of surgical and medical ophthalmology.

In addition to contributing greatly to

the success of many medical society meetings, Dr. Lillie was the author of numerous articles dealing with ophthalmology and was co-author of the textbook, *Cardio-Vascular Renal Disease*. He was also a contributing editor of the *Pennsylvania Medical Journal* and *Confinea Neurologica*.

Small-game hunting and trap shooting were his hobbies, and he was a member of the Philadelphia Country Club, the Roxborough Gun Club, and the Atlantic Indians.

Dr. Lillie always saw the brighter side of life and was so sincere and encouraging that he was able to infect others with his own contagious optimism. Even the briefest conversation with him was a tonic. His charm and ability brought him the love and respect of his patients and colleagues, alike.

Although his practice was large and demanding, Dr. Lillie never allowed it to interfere with his teaching and administrative duties. He contributed greatly to scientific literature through his own writings and to the practice of ophthalmology not only through his own participation in that specialty, but also through his active interest in training others to work in that field.

It has been said that the prerequisites for a successful physician are that he be honest, kind, and competent. Such was the way of life for Walter Ivan Lillie, and his passing has left a tremendous void in the lives of his family, friends, and medical colleagues.

P. Robb McDonald.

CORRESPONDENCE

GOOD, BUT NOT GOOD ENOUGH: OUR CHALLENGE

Editor,

American Journal of Ophthalmology:

The recent rapid development of interest in Industrial Vision is bringing to the office of the professional man a new type of patient. This patient is not seeking professional advice because he has become aware of a problem which he believes is associated with his vision or because he considers his vision to be faulty or below the ordinarily conceived normal. He is seeking professional advice because he is unable to compete adequately with his fellow workers on his job in those phases of effort that have to do with seeing skills.

Very frequently it is found that such patients were not originally aware, on the basis of their own observation, that their job difficulty might be due to their vision. The possible relationship between vision and industrial performance is often revealed by various fact-finding methods used by analysts working in and with industry, who have by previous controlled studies ascertained definite and varying patterns of visual skills matching job demands which make for success on the job.

These findings are further scrutinized and evaluated by professional consultants of a plant and are thus approved for use in that plant. An employee whose visual skills do not fit this pattern is directed to a professional man for investigation of his vision. He may not be personally aware that his vision is in need of attention. He has been told that in all probability his work would be better if he were able to receive visual aid.

As would be expected, visual demands in industry are sometimes more deliberately evaluated than are the symptoms which bring the usual patient to the doctor's

office. Ordinarily a patient does not seek advice until his vision is obviously disturbed and he has cause for alarm. In industry, workers are being requested to seek professional assistance before their visual skills indicate serious trouble. They are being urged to visit the professional man when visual disturbances fall into a category where they can be diagnosed only in terms of an increased, although not always obviously recognizable, difficulty in performing the industrial task.

It is, therefore, to be expected that among these industrial patients the proportion of individuals with severe visual defects is much lower than among a random group of ordinary patients. The visual demands of industry are intricate and sometimes the worker whose visual skills fall well within the normal by the usual clinical criteria may nonetheless experience difficulty in performing his job. Where we would normally hesitate to ask a patient to change his lenses if he read 20/20, O.U. for near, so that he could read 20/15, we now need to realize that a job pattern may indeed demand 20/15 and then we must prescribe the change. The same may be true of a symptomless exophoria which nevertheless is found by statistical methods to be improper for a certain job and therefore should receive orthoptic training. Some learn, reluctantly perhaps, that a man can be handicapped in the performance of his job because he may require better than normal eyes.

One job which the authors recently observed in a printing establishment involved the preparation of lithographic plates. These workers were comparing photographic negative plates with original copy for shading of colors and silhouetting. Exact shades of color are obtained by varying the concentration of the dots which in the finished plate will transfer

the color to the page. These dots are so small as to be barely discernible with the naked eye but the worker must obtain the proper concentration (to insure the proper shade) and the proper distribution (to insure proper silhouetting of the picture detail). The worker on such a job must seek "better than normal" eyes. His near visual skills are of greatest importance. By statistical analysis it was found that the best workers on this job showed near-vision acuity equivalent to 20/15 or better, at 13 inches—not at the usual 20/20.

Therefore, workers whose near visual acuity was the equivalent of 20/20 were being referred to professional men for further visual aid (if possible), since their job required at least an equivalent of 20/15. Here the professional man must adjust his usual clinical concept of when to correct acuity further and must prescribe for the best possible acuity. He must recognize the need of some highly specialized workers for extremes of perfection in visual functions.

Similar critical qualities of vision are found necessary for such jobs as hosiery looper, gager of fine parts, assembler of small mechanisms (such as cameras and watches), to name but a few. Among 450 industrial jobs studied by the Occupational Research Center, Purdue University, 10 percent were found to require distant-vision acuity in both eyes better than 20/20; 20 percent were found to require better than 20/25. Among the same group of jobs, 13 percent were found to require acuity better than 20/20 at 13 inches, and 33 percent, or one third, better than 20/25.

These figures illustrate the number of jobs where visual demands are such that workers with normal or near-normal vision may, nevertheless, actually be handicapped to a degree in performing their specific industrial tasks. Furthermore, the standards used by industry are usually *minimum* standards and represent only the vision needed to keep up on the industrial job. For more success and more outstanding performance, even higher visual acuities may often be desirable.

It becomes apparent, therefore, that the professional man treating industrial patients must add to his present task of correcting visual defects—a brand new concept of effort, that of improving visual *skills* which may include one or more factors (especially acuity and muscle balance). The clinical methods of improving these skills are already in use but our attention must be focused more sharply on them. New testing methods and new correcting procedures are being developed to meet the increasing challenge of this task. Our present equipment, especially for near-point problems, is inadequate.

No longer is the professional man responsible only for giving assistance where some obvious clinical impairment is recognized, but he must now seek to provide additional assistance where job demands require raising the workers' visual skills above the category "good" to the one of "best."

Hedwig S. Kuhn,
Hammond, Indiana.

Newell C. Kephart,
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ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

1

GENERAL METHODS OF DIAGNOSIS

Contino, Filippo. A new method of determining pupillary diameter. *Rassegna Ital. d'Ottal.*, 1946, v. 15, Nov.-Dec., pp. 450-460.

The author has constructed an apparatus composed of a telescope and a Lobeck measuring ocular. The chinrest of the biomicroscope table is used and the measuring device is attached to the movable arm of the same. (2 figures.)
Eugene M. Blake.

Hughes, W. L. A combination red filter and occluder. *Amer. Jour. Ophth.*, 1947, v. 30, May, p. 609.

Owens, W. C. A fixation light for the cardinal directions of gaze. *Amer. Jour. Ophth.*, 1947, v. 30, May, pp. 611-613. (9 references.)

2

THERAPEUTICS AND OPERATIONS

Bakker, A. The action of sulphanilamide on rabbits' lenses in vitro. *Brit.*

Jour. Ophth., 1947, v. 31, April, pp. 216-219.

Sulphanilamide, not above the therapeutic level, is quite harmless for explanted lenses of rabbits. When the concentration is elevated, it is noted that the lenses from very young rabbits become opaque; however the toxicity of sulphanilamide for lenses from adult rabbits is less pronounced.

O. H. Ellis.

Cavazzini, Mario. The activity of penicillin in the presence of pupillomimetic drugs. *Rassegna Ital. d'Ottal.*, 1946, v. 15, Nov.-Dec., pp. 518-529.

The extreme lability of penicillin and the fact that such drugs as atropine, pilocarpine, and adrenalin are frequently employed locally at the same time as the penicillin, induced the author to study the effects of such drugs upon therapy with penicillin. The latter is a monobasic acid (pH about 2.8). The miotics, mydriatics, and local anesthetics were introduced into solutions of penicillin in vitro and did not

affect the potency of the antibiotic; nor did the latter exert a baneful effect upon the action of the drugs. No incompatibilities were discovered. (2 figures.) Eugene M. Blake

Cortes, Herman. Results of sulphonamide therapy in ophthalmology. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, July, pp. 664-672.

A detailed study of each patient that was successfully treated with sulphonamide is reported. The lesions were acute and purulent conjunctivitis, corneal ulcers with hypopyon, and metastatic endophthalmitis. The drug used was Albucid (sulfacetamide) and was administered locally and systemically.

J. Wesley McKinney.

Costi, C., and Alvarez Maribona, T. Use of crystalline penicillin in ophthalmology. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, July, pp. 644-653.

The authors report the good results obtained by the local use of crystalline penicillin in acute, subacute, and chronic conjunctivitis, trachoma, acute, subacute, and chronic dacryocystitis, corneal ulcers, and corneal ulcers with dacryocystitis. The detailed study of each patient is described briefly.

J. Wesley McKinney.

Dubois-Poulsen, A. Retrobulbar ciliary neurotomy. *Ann. d'Ocul.*, 1946, v. 179, Nov., pp. 578-590.

As a substitute for enucleation in painful blind eyes, especially in glaucoma, opticociliary resection was abandoned because of severe complications including orbital hematoma and exophthalmos. Destruction of the ciliary ganglion involves a complicated technique and trophic corneal disturbances are not infrequent. Section of the ciliary nerves between the ganglion and the

eyeball is preferable. After canthotomy the conjunctiva is dissected from the limbus above and below and the external rectus is temporarily resected. Arruga's speculum for retinal detachment is introduced and the long ciliary nerves are fixed between two strabismus hooks and cut. The external rectus is replaced and the canthotomy and conjunctiva are sutured with silk. The operation is followed by few complications. The tension after a brief drop may rise to its previous level, but the corneal edema is permanently relieved. Seven illustrative cases which are presented include primary glaucomas and glaucomas following hypertensive retinopathy and venous thrombosis. (27 references.) Chas. A. Bahn.

Duguid, J. P., Ginsberg, M., Fraser, I. C., Macaskill, J., Michaelson, I. C., and Robson, J. M. Experimental observations on the intravitreal use of penicillin and other drugs. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 193-210.

The authors present results of experiments on the intravitreal injection of penicillin and other drugs. Commercial penicillin, sodium sulphacetamide, mafenil and V. 335(p-methyl sulphonyl benzylamine) introduced into the vitreous were damaging to the retina to a degree which excluded their use clinically. Sodium sulphacetamide and pure penicillin either together or separately in the vitreous were found to diffuse rapidly into all parts of the eye, and the vitreous acted as a depot for replenishing the drug lost from the other tissues. It was found that pure sodium penicillin was highly effective in the control of infections of the vitreous body, and that chemo-therapeutic levels could be maintained by intravitreal injections of 2000 units every two days. Pure sodium penicillin caused minimal

retinal destruction, and its use seems indicated and justifiable in certain cases of infection. O. H. Ellis.

Garcia Miranda, A. Penicillin in ophthalmology. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, July, pp. 617-643.

The author has made a complete review of the literature on the tolerance of the various ocular tissues for penicillin and the concentration of penicillin in these tissues after various methods of administration. It was found that penicillin reaches the highest concentration in the tissues when it is given locally. Good results were obtained by means of this drug in the treatment of blepharitis, conjunctivitis, keratitis, infection of the uveal tract and some other intraocular septic processes.

J. Wesley McKinney.

Kornerup, Tore. Investigation in variable monochromatic light of the outer vessels of the eye. *Acta Ophth.*, 1946, v. 24, pt. 4, p. 423.

Nine cases of inflammation are reported, in which areas of pericorneal injection were examined in variable monochromatic light. The shifting of the diffusion spectrum at various stages of the inflammation that produced the pericorneal congestion is illustrated with graphs, and is attributed by the author to the marked difference of the diffusion spectrum from arteries and veins. The changes in the diffusion spectrum were different in periods of clinically demonstrable improvement and of persistent inflammatory process. In several cases a change in the diffusion spectrum indicative of improvement preceded the clinical symptoms.

Ray K. Daily.

Matteucci, Pellegrino. The effect of retrobulbar injection of alcohol upon

ocular tissues. *Rassegna Ital. d'Oftal.*, 1942, v. 11, Nov.-Dec., p. 483.

Following the retrobulbar injection of alcohol there may result exophthalmos, chemosis, hypoesthesia of the cornea, mydriasis and pupillary torpidity, corneal alterations, variations of tension and vasodilatation of the vessels of the orbit, uvea and retina. The optic nerve does not present appreciable histologic alterations. Injection of over 70 percent solutions of alcohol should be given guardedly where vision is good or any corneal change exists. The treatment is limited to patients with absolute or hemorrhagic glaucoma, where severe pain is present. The reduction of tension in glaucoma is not sufficient to warrant the injection in acute or chronic simple glaucoma. Vasodilatation sometimes follows and weak concentrations of alcohol may be employed in iridocyclitis with hypertension. In experimental animals the vasodilatation was evident in microscopic sections of the optic nerve, retina and orbit. (4 figures.)

Eugene M. Blake.

Rosengren, Bengt. On the depth of cauterization in surface diathermy, with special reference to amotio operations. *Acta Ophth.*, 1946, v. 24, pt. 4, pp. 389-416.

Investigations in which cattle liver was used as test material showed that the depth of cauterization is influenced by several factors. It is increased if the water content of the surface is high. It is greater if diathermic coagulation is performed with a weak current acting for a longer time, than with a strong current acting for a shorter time. It increases with the size of the electrode. If the degree of moisture in the surface, and the time of coagulation are standardized, it is possible to regulate the

depth effect quite accurately by using different sizes of electrodes. The author found that an even and adequate penetration is obtained when he uses a ball electrode 1.25 or 1.00 mm. in diameter on a slightly damp scleral surface, and when pergmentization appears in 2 to 3 seconds. (5 illustrations.)

Ray K. Daily.

Vannas, Mauna. On the use of rib cartilage grafts for correction of cosmetic defects caused by enucleation. *Acta Ophth.*, 1946, v. 24, pt. 3, pp. 225-237.

After a brief review of the literature on the various type of implants used after enucleation, Vannas reports the technic of implantation of rib cartilage that is covered by perichondrium. On the basis of 36 operations, he regards this as the most satisfactory implant material. The implant is covered with a pouch that is made with the help of catgut suture, over which the four rectus muscles are tied with catgut. The conjunctiva is closed with silk. The perichondrium is expected to prevent absorbtion of the cartilage. To correct retraction of the upper lid Vannas uses implantation of perichondrium, with almost no cartilage. From the free end of the patient's lower rib a piece of cartilage 3 cm. in length is excised; it is split longitudinally, and almost all the cartilage is removed; the two thin plates of perichondrium are placed against each other, surface outwards. A vertical incision 1 to 1½ cm. in length is made lateral and superior to the external canthus, and a shorter incision is made nasally. With curved scissors an arch shaped space as high as possible under the supercilium, and under the fibers of the orbicularis is prepared, and the implant is pulled into it by a clamp introduced through the nasal incision.

Since retraction of the upper eyelid is unpredictable, Vannas suggests that at the time of enucleation a piece of cartilage be excised, and buried subcutaneously in the chest wound, to be easily available if required later.

Louis Daily, Jr.

Wofflin, E. A new procedure for extraction of intraocular nonmagnetic foreign bodies. *Ann. d'Ocul.*, 1946, v. 179, Nov., pp. 591-593.

Some amalgams have the power of adhering firmly to metals on contact. In the author's experiments with this ingenious idea, he used copper, silver, and sodium amalgams on very fine rods to remove zinc, copper, and aluminum foreign bodies imbedded in gelatin that had the consistency of human vitreous. Animals' eyes were also used in these experiments. The amalgam of sodium solidified faster but was possibly irritating to the human eye, although not to the eyes of guinea pigs. Five minutes or more of contact was necessary for a suitable catalytic adhesion. The amalgam must solidfy at the normal temperature of the human vitreous. The author desires to interest other ophthalmologists in the experimental development of the ophthalmic use of amalgams, especially in the removal of intraocular nonmagnetic foreign bodies.

Chas. A. Bahn.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Bárány, Ernst. A theory of binocular visual acuity, and an analysis of the variability of visual acuity. *Acta Ophth.*, 1946, v. 24, pt. 1, pp. 62-92.

The literature is reviewed, and the causes of the variability of instantaneous visual acuity discussed. The method used in this investigation is

described in detail; it consisted essentially of instantaneous exposure of Landolt rings, with a rotating apparatus, under a standard illumination, and with an apparatus which was equipped with automatic regulation of the exposure time. The average instantaneous acuity variability in about 30 eyes was found to be ± 20 to 25 percent of the visual acuity value. A new explanation is advanced for the higher visual acuity even in emmetropic subjects when both eyes are used. It is based on the assumption that the instantaneous acuity fluctuations are due mainly to causes individual for each eye, and that consequently when both eyes are used one eye can see well at the instant when the other eye sees badly. No central cooperation beyond this random inter-complementing is assumed. The mathematical calculations of these assumptions agree with the experimental results, and indicate that the cerebral factor is not significant.

Ray K. Daily.

Eames, T. H. A study of tubular and spiral central fields in hysteria. *Amer. Jour. Ophth.*, 1947, v. 30, May, pp. 610-611. (9 references.)

Koch, Walter. An improved dark-adaptometer. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 235-237.

A redesigned and improved dark-adaptometer is presented. Filters of different colors can be brought into position as well as neutral filters for altering the intensity of light. The instrument allows for a wide range of readings on patients with gross disturbances of dark adaptation.

O. H. Ellis.

Mandelbaum, J., and Sloan, L. L. Peripheral visual acuity: with special reference to scotopic illumination.

Amer. Jour. Ophth., 1946, v. 30, May, pp. 581-588. (1 table, 2 figures, 7 references.)

Martin, L. C., and Pearse, R. W. B. The comparative visual acuity and ease of reading in white and colored light. *Brit. Jour. Ophth.*, 1947, v. 31, March, pp. 129-144.

These experiments were performed to determine differences in visual acuity and in ease of reading in white and in red light. A view box was designed in which all factors remained constant including the intensity of the white or red light. The test object was a slide on which was printed a grating with 55 lines to the inch. The general levels of illumination used were approximately 0.06, 0.6, 6.0 foot candles. The tests were binocular and the observers varied in age from 14 to 50 years. The results are recorded in detail in tabular form. They indicated that among the lower levels of illumination, red light was as much as 80 percent more efficacious than white and at the higher levels there was little practical difference.

In studying the ease of reading the observers were made to read separate, plainly printed words in varying intensities of white and red light and the numbers of words read were recorded. There was little practical difference, although white was probably better in higher levels and red better in lower levels. A third and purely subjective test of simply having the observers read for 30 minutes by the two lights and describe differences in ease and comfort revealed again no appreciable differences.

Morris Kaplan.

Stomberg, A. E. The psychology of the squinter. *Amer. Jour. Ophth.*, 1947, v. 30, May, pp. 601-606. (6 references.)

4

OCULAR MOVEMENTS

Carelli, P. V. Relation of the near point of convergence to squint surgery. *Illinois Med. J.*, 1947, v. 91, March, pp. 124-126.

Primary divergence insufficiency should be treated by surgery on the external rectus muscles. Accommodative convergence excess should have a trial period of glasses and atropine, whereas a moderate recession of the stronger internal rectus is indicated when there is no accommodative factor.

Irwin E. Gaynon.

Cojazzi, Luigi. Acoustic phenomena provoked by ocular movements. *Riv. Oto-Neuro-Oft.*, 1943, v. 3, May-June, pp. 165-174.

A 25-year-old man developed signs of arachnoiditis of the posterior cranial fossa after a radical operation performed for otitis media of his left ear. Gaze to his left was accompanied by a noise of constant pitch inside the left ear which disappeared when the eyes returned to the primary position. The author discusses the explanations offered in the literature for this rare phenomenon and assumes that in his case an irritation of the vertebral sympathetic vasomotor system was responsible for the noises. (Bibliography.)

K. W. Ascher.

Levit, L., and Giqueaux, R. Supranuclear ophthalmoplegia. *Anales Argentinos de Oft.*, 1946, v. 7, July-Aug.-Sept., pp. 75-78.

A twelve-year-old child is presented with a history of encephalitis at the age of eight months. At the present time there is a total peripheral facial paralysis, more marked on the right side, a right lingual hemiatrophy, and loss

of all conjugate eye movements. The lesion is believed to be supranuclear and probably in the posterior longitudinal fasciculus. Edward Saskin.

Malbran, Jorge. Etiopathogenesis and therapeutics of strabismus. *Arch. Chilenos de Oft.*, 1946, v. 2, March-April, pp. 95-104.

This well-written article of ten pages deals especially with the problem of amblyopia in relation to prognosis from treatment, and with the surgery of the condition.

W. H. Crisp.

Suarez Villafranca, Manrique. Surgery in strabismus. *Arch de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, July, pp. 676-686.

In the surgical treatment of strabismus the author performs partial tenotomy of the inferior two-thirds of the antagonistic muscle and spreads the untouched fibers. With this technique he obtained good results in 75 percent of patients. The other 25 percent (deviations over 7mm.) showed slight hypocorrection of one and a half millimeters. In these patients tenotomy of the muscular fibers untouched in the first operation was done. Of 47 patients, 41 had convergent squint and 6 divergent. This method failed in only three. (11 illustrations.) J. Wesley McKinney.

5

CONJUNCTIVA

Colombo, G. L., see Luiggi, Gan, this section. Prof. Colombo of Milan has informed us that the *Ann. d'Ocul.* inadvertently credited his article to Gan Luiggi (Colombo), instead of Gian Luigi Colombo.

Luiggi, Gan. Rickettsia in nummular epidemic conjunctivitis. *Ann. d'Ocul.*, 1946, v. 179, Nov., pp. 594-596.

It is probable that conjunctival Rickettsial diseases vary greatly in their pathologic and clinical patterns. In a patient with acute epidemic conjunctivitis the bacterial findings were negative, but Rickettsial bodies were present. The technique included alcohol-ether fixation for 5 hours, Giemsa staining for 24 hours and subsequent rinsing. The Rickettsial bodies observed were smaller and less regular than those in trachoma. (3 references.)

Chas. A. Bahn.

Murray, J. O. Stevens-Johnson syndrome, report of two cases. *Lancet*, 1947, v. 1, March 15, pp. 328.

The author reported two cases of Stevens-Johnson syndrome, one with only mild conjunctivitis, and the second with profuse purulent conjunctival discharge, but without corneal inflammation. Both patients ran a comparatively mild course and cleared completely. This was interesting, as the author points out, because in many of the previously reported cases serious ocular complications have occurred, including blindness. O. H. Ellis.

Nellen, Maurice. Stevens-Johnson syndrome. *Lancet*, 1947, v. 1, March 15, pp. 326-327.

A case of Stevens-Johnson syndrome with severe constitutional symptoms and eruptions affecting the skin and mucosa is reported. Accompanying the purulent conjunctivitis, granular swellings were present in the upper quadrants of the bulbar conjunctiva. These were possibly the remains of subsiding vesicles, but cleared without complications. Patients with similar findings have been reported elsewhere as "erythema exudativum multiforme plurifacialis," and under other headings.

O. H. Ellis.

Thygeson, P. Clinical signs of diagnostic importance in conjunctivitis. *Jour. Amer. Med. Assoc.*, 1947, v. 133, Feb. 15, pp. 437-441.

There are a number of clinical signs, both gross and biomicroscopic, which are of diagnostic importance in conjunctivitis.

Changes in the regional lymph nodes, the lid margins, the limbus and cornea are of almost equal diagnostic importance with those occurring in the conjunctiva itself. By clinical examination alone it is possible to identify many of the various etiologic types of conjunctivitis. When these clinical observations are correlated with cytologic and bacteriologic studies, the cause can be determined in a high percentage of cases.

Theodore M. Shapira.

Willcox, R. R., Findlay, G. M., and Henderson-Bebb, A. Treatment of Reiter's syndrome by gold salts. *Brit. M. J.*, 1947, April 12, pp. 483-484.

Certain strains of pleuropneumonia-like organisms give rise to arthritis and conjunctivitis in rats and mice. Pleuropneumonia-like organisms are sensitive to gold salts. Two patients with Reiter's syndrome were cured by the use of gold salts (Myocrisin,) whereas adequate dosage of typhoid, penicillin, and sulfthiazole therapy failed to be of any value.

Irwin E. Gaynon.

6

CORNEA AND SCLERA

Almeida Rebouças, José de. Corneal ulcer from varicella. *Rev. Brasileira de Oft.*, 1946, v. 5, Dec., pp. 105-114.

The author records five cases of corneal ulcer from varicella, in which the clinical course differed from that ordinarily described for cases in other parts of the world. Previous case

records have mentioned mild photophobia, mild pericorneal injection, rapid cicatrization, ready healing under ordinary therapy, and a delicate final scar interfering little with visual acuity. The author's patients had intense photophobia, intense pericorneal injection, cicatrization requiring from two to four months, resistance to all therapeutic measures, and a subsequent dense leucoma with considerable reduction of visual acuity. W. H. Crisp.

Casari, G. F. Acute pemphigoid of the cornea. *Rassegna Ital., d'Ottal.*, 1946, v. 15. Nov.-Dec., pp. 511-517.

The case described occurred in an 11-year-old girl, ill with polyarticular rheumatism and endocarditis. Small hemorrhagic spots appeared first upon the face and then became general. Even the palms of the hands showed vesicles filled with serohemorrhagic fluid and the oral mucosa was affected. On the twenty-eighth day the left cornea became completely opaque and soon a large central ulcer with purulent secretion developed. There was no glandular enlargement. Smears and culture showed extracellular cocci in clusters, with 2 percent of eosinophiles. Healing eventually took place but vision was reduced to light perception. The term pemphigoid is applied to this condition to correspond to the more recent classification of bullous cutaneous eruptions.

Eugene M. Blake.

Figueiredo, N. P. de. Opacification of the cornea from obstetric traumatism. *Rev. Brasileira de Oft.*, 1946, v. 5, Dec., pp. 115-119.

After forceps delivery, in addition to local swelling and hemorrhages, the left cornea was completely opaque. The condition rapidly improved, and after 61 days all that remained of the dis-

turbance were some striae. The condition has been attributed to rupture of Descemet's membrane, with secondary swelling. W. H. Crisp.

Nectoux, R. Keratitis in epidemic parotitis. *Ann. d'Ocul.*, 1946, v. 179, Nov., pp. 597-600.

Among the rarer complications of mumps is keratitis. Less than ten cases have apparently been reported in the world literature. During an attack of epidemic parotitis a 47-year-old woman had a transient corneal edema in one eye with slight ciliary injection that lasted about one month. There were numerous folds of Descemet's membrane, the cornea was temporarily hypesthetic and numerous erosions existed on the anterior surface. Complete healing occurred within 30 days. (5 references.) Chas. A. Bahn.

Pickrell, K. L. Tattooing of corneal scars with insoluble pigments. *Plastic and Reconstructive Surg.*, 1947, v. 2, Jan., pp. 44-59.

Knapp first introduced this technique in 1925. Pischel, in 1930, spoke of its failure and only one article has been written on the subject since then.

The effect of 2-percent and 5-percent preparations of iron, gold, silver, and platinum on the intact and the de-epithelized cornea of rabbits was noted. Corneal scars were first produced in albino rabbits by instilling 10-percent solution of formalin into their eyes. The scars were first tattooed with a single pigment. There was no change even after several months. Injections of colors for detailed shades were next made seven to ten days after the first or basic color injection. The final desired color could not be obtained by mixing the necessary pigments and using this mixture at one time.

Three cases of tattooing in man are presented; the patients were white females aged 7, 18, and 20 years respectively. Three tattooings about two weeks apart were performed in the child; the others received four, at five to six day intervals. Slight discomfort from photophobia was the main complaint following the treatments. After 12 to 18 months there has been no fading or dispersion of pigment. In these cases vision seemed improved by a reduction in the photophobia when light from troublesome intraocular beams were absorbed in the cornea.

Francis M. Crage.

Pinticart de W., E. Tuberculosis, tuberculoses, tuberculous toxemias, and tuberculin therapy. *Rev. Brasileira de Oft.*, 1947, v. 5, March, pp. 159-166.

These subjects are very briefly considered by the author, whose paper is mainly devoted to the report of a personal case. A woman of 29 years, who had three living children and had lost one from an intestinal affection, was again in an early stage of pregnancy. An-ocular inflammation was attributed to a blow on the eyebrow two weeks previously. The inflammation, which was a keratitis, and which had been noted on the hospital record at the eighth month of a previous pregnancy, appeared to have become aggravated by the present pregnancy. Ocular pain became less after artificial interruption of the pregnancy; but a month later a small tubercle of the iris was found although the eye was no longer congested. Sterilization was recommended.

W. H. Crisp.

Volero, M. Neuroparalytic keratitis and heterochromia in syringomyelia. *Rassegna Ital. d'Ottal.*, 1942, v. 11, Nov.-Dec., p. 435.

Volero describes a case of neuroparalytic keratitis and heterochromia in a patient with the bulbar type of syringomyelia. He concludes that the trophic changes which develop in the cornea are not due, as is commonly held, to a lack of trophic impulses, nor to the presence of abnormal irritative stimuli, but to the loss of the normal control exercised by antidromic impulses resulting from faulty cellular exchange. The keratitis is due directly to the syringomyelia and not to the loss of lacrymal secretion.

Eugene M. Blake.

Zondek, B., Landau, J., and Bromberg, Y. M. Allergy to endogenous hormones as a cause of keratitis rosacea. *Brit. Jour. Ophth.*, 1947, v. 31, March, pp. 145-155.

Zondek has previously shown that the occurrence of typical allergic symptoms as a result of hypersensitivity to endogenous hormones is not uncommon. In this report six cases of rather severe keratitis rosacea that resulted from proved sensitivity to testosterone are reported. All patients had been refractory to the usual methods of treatment. They were treated by desensitization to testosterone by a course of subcutaneous injections supplemented by implantations of 10 mg. of the hormone under the skin. Improvement was appreciable.

Morris Kaplan.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Bárány, E. H. The influence of intraocular pressure on the rate of drainage of aqueous humour. Stabilization of intraocular pressure or of aqueous flow. *Brit. Jour. Ophth.*, 1947, v. 31, March, pp. 160-176.

These experiments were performed to investigate the existence of a mechanism for regulating intraocular tension by slowing or speeding the rate of aqueous flow. Such a mechanism is assumed to exist. All previous experiments have actually been unphysiological in that in all some trauma was inflicted upon the eye. Bárány maintained a completely normal physiologic relationship and arrived at contrary conclusions. The changes in tension were accomplished by pressure on the unilateral common carotid artery. The rate of aqueous flow was determined by the use of a radio-active sodium isotope as a tracer substance. It was shown that the sodium concentration remained approximately the same in the two eyes though only one underwent pressure changes as great as 20 percent.

Morris Kaplan.

Cyukrasz, Ida. A case of bilateral genuine iris-atrophy. *Brit. Jour. Ophth.*, 1947, v. 31, March, pp. 176-179.

A 24-year-old woman complained of blindness in one eye and poor vision in the other. The tension in each eye was 56 mm. Hg. In each eye the iris consisted mostly of atrophic strands of varying width, some of which adhered to the lens. Cornea, lens, vitreous and retina were normal and both discs showed deep glaucomatous cupping. No evidence of previous inflammation could be found and the diagnosis of genuine iris-atrophy was made. It probably arose as a regression in the pupillary evolution in the fourth month of prenatal life. Cyclodialysis in the right eye was followed by normal tension.

Morris Kaplan.

Francois, J. Heterochromia iridis of Fuchs. *Ann. d'Ocul.*, 1946, v. 179, Nov., pp. 559-576.

Six cases of heterochromia iridis are presented to illustrate the different stages and types of this condition. Diminishing density of the iris stroma with subsequent atrophy and pigment absorption and dispersion especially in the posterior portion constitute the principal pathologic feature. Associated are noninflammatory corneal precipitates, posterior cortical lens opacities and imbalance of the sympathetic nervous system, usually of the parietic type. Among the rarer complications are glaucoma, retinal detachment, and vitreous degeneration. The symptoms usually begin about the age of 20 years. Usually there is ciliary injection and synechias are completely absent. The principal explanatory theories postulate inflammation, sympathetic nervous system degeneration, and dysraphic degeneration. No single theory apparently explains all cases. Fuch's heterochromia iridis is apparently a degenerative genetic syndrome, involving defective structure of the iris and lens with partial or complete lack of normal tissue repair. Another part of the syndrome is a degeneration of the autonomic nervous system especially involving the cervical sympathetic portion.

Chas. A. Bahn.

Hartmann, E., and Braun-Vallon, S. Ocular toxoplasmosis. *Ann. d'Ocul.*, 1946, v. 179, Oct., pp. 524-530.

Bilateral disseminated chorioretinitis involving the perimacular region suggests toxoplasmosis, particularly in infants. The parasite is 4 to 6 μ by 2 to 3 μ pear shaped, easily inoculated into guinea pigs and mice, and is frequently found in rodents and birds. The exact mechanism of infection, especially of infants, is not known.

In infants the infective process is essentially an encephalomyelitis which

is frequently fatal. Mothers usually have antibodies in their blood but are free from symptoms. In older children and adolescents the process is less acute with fewer constitutional symptoms. In adults the liver and spleen are frequently involved in the general infection, which is usually less severe than in the young and which clinically resembles Rickettsia infections, especially typhus fever. The basic lesion is a small perivascular granuloma in which lymphocytes, epithelioid cells and occasionally eosinophiles are present. The infection reaches the primarily involved choriocapillaris and the first neurone of the retina through the blood stream. The chorioretinal lesions may be confused with those of hereditary lues, small pox, measles, tuberculosis, lead poisoning, and congenital coloboma. The location of the ocular lesions, the absence of marked proliferative changes, and the bilateral occurrence are characteristic. The extraocular symptoms, positive complement-fixation test in the acute stage, positive rabbit and mouse inoculation, and calcium deposits in the cerebellum further facilitate differential diagnosis. (18 references.)

Chas. A. Bahn.

Jona, S., and Bauce, A. Considerations on an atypical case of Harada's Disease. *Riv. Oto-Neuro-Oft.*, 1946, v. 21, May-Aug., pp. 168-182.

A woman, 43 years of age was suddenly taken sick with violent headache and high fever. After a few days, there was loss of vision of the right eye. Ophthalmoscopic examination revealed a red reflex from the fundus and a retinal detachment below. Her spine was rigid, and the spinal fluid contained lymphocytes. There was also a reddish maculo-papular eruption on the skin and vesicular lesions of the lips and

mouth. The general symptoms abated in a short time but seclusion of the pupil persisted. The herpetic lesions of the mouth suggest that the disease was caused by a herpetic virus which was uveotropic. (Bibliography.)

Melchiorre Lombardo.

Laval, Joseph. Hemorrhage in sarcoma of the choroid. *Amer. Jour. Ophth.*, 1947, v. 30, May, pp. 607-609. (4 figures.)

Martin-Jones, J. D., Uveal Sarcomata. *Brit. Jour. Ophth.*, 1946, Monograph Supplement 11.

This monograph brings our knowledge and the literature of this large subject up to date. Two hundred and sixty-three cases were completely investigated. Heredity was a possible factor in only two instances, and although trauma was often mentioned, it was a very questionable causative agent. Previous choroidal hemorrhages and old pigmentary changes in the fundus were, in some cases, thought to be predisposing factors. The condition appeared equally in the two sexes and at any age. The average age was in the sixth decade. Most of the eyes were nearly blind at first examination; however five had 6/6 vision.

The average duration of symptoms was 19 months, and differential diagnosis was rarely difficult when the fundus was clearly seen. In no case was a hole or tear of the retina seen with sarcoma of the choroid, and detachments with increased intraocular pressure (present in 50 percent of cases) were usually neoplastic in origin. The glaucoma may have been caused by the formation of a plasmod type of fluid, as well as the usual mechanical blockage.

The choroidal type is the most com-

mon intraocular sarcoma and most frequently arises in the posterior pole. Bilateral or multiple choroidal sarcomas are extremely rare. The spindle celled growths are the most common, those composed of epithelioid cells alone are rare, and the mixed cell type is the most malignant.

The author presents a comprehensive discussion of the origin of these tumors, and conclusively shows them to be mesoblastic in origin.

More than one half of the patients died within ten years after operation. The patient who survives for ten years is probably cured. Malignant cells in the emissaria are not necessarily of bad prognostic import but extraocular involvement is. There was no evidence to show that intracranial extension of the growth occurred when the optic nerve was invaded by sarcoma cells. Reticulum staining on a group of specimens confirmed the work of Callender and Wilder as to the prognostic importance of the content of the reticulin fibers in the tumor.

Extraocular extension of the growth is the exception and not the rule, and early enucleation is the treatment of choice. Exenteration of the orbit does not increase the chance of survival and radium or X-rays probably are as effective.

Sarcoma of the iris is rare. It arises from proliferation of the stroma cells, usually on the lower half of the iris and also should be removed early by enucleation. (20 illustrations and photomicrographs.)

O. H. Ellis.

Matteucci, Pellegrino. Sympathetic innervation of the uvea and its neurovegetative regulation. *Rassegna Ital. d'Ottal.*, 1946, v. 15, Nov.-Dec., pp. 484-498.

Mawas demonstrated a neurovega-

tive regulatory system in the retina and along the course of its vessels. This system consists of ganglion cells and microganglia of a sympathetic nature. This is contrary to the usual opinion that the retinal arteries are not under direct influence of vasomotor nerves. Matteucci conducted experiments upon rabbits and disagrees with Mawas and Magitot. His experiments seemed to show that the autonomic regulation of the uveal vessels is a sinus reflex, which regulates the intracranial and general arterial pressure and appears to act in a direct manner through the medullary bulb upon the caliber of the uveal vessels and the ocular tension. The sympathetico-adrenal and parasympathetico-colinergic systems are represented only by way of transmission of these reflexes.

The vacillations of general arterial pressure do not seem to act in a mechanical sense upon the caliber of the uveal vessels. Considerable difference of opinion exists among physiologists, anatomists, and others working upon the problem of the nervous control and uveal vessels, general and vascular arterial pressure and in intraocular tension, and knowledge in this field is in a state of flux. (2 figures.)

Eugene M. Blake.

Pinticart de W., E. Tuberculosis, tuberculoses, tuberculous toxemias, and tuberculin therapy. *Rev. Brasileira de Oft.*, 1947, v. 5, March, pp. 159-166. (See Section 6, Cornea and sclera.)

Roper-Hall, M. J. Research in Zurich. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 223-228.

The author presents a summary of the work done at Zurich on the pathological changes in the aqueous humor and the blood-aqueous barrier. Over

1900 anterior chamber punctures were done on normal and diseased eyes. The cells, which are increased in inflammation, originate in the blood and neighboring tissues. The predominant role of the reticuloendothelial system in a great number of cases of chronic uveitis was noted. Albumin was increased in proportion to the number of cells, and in chronic inflammations there was a dissociation found between the albumins and the cells, comparable to that observed in the pathologic cerebrospinal fluid. Cultures were rarely positive even with strongly positive smears, and tubercle bacilli were found in only one case. Organisms found in the anterior chamber in keratitis and anterior uveitis were of etiologic significance.

The permeability of the blood-aqueous wall was studied with the intravenous fluorescein method. Trauma, uveitis, and most general diseases show an increased permeability; however the findings in glaucoma varied. It was found that the fluorescein test showed more minute changes in the permeability of the wall than the Tyndall effect.

O. H. Ellis.

Rubino, A., and Rosselli del Turco, L. A case of uveitis with vitiligo; study of Vogt-Koyanagi's disease. *Riv. di Oftalm.*, 1946, v. 1, Sept.-Oct., pp. 553-571.

A 15-year-old girl had been suffering from bilateral iridocyclitis since the age of 9 years. At the age of 8, she had a tracheobronchial adenopathy accompanied by loss of weight and one year later pulmonitis was diagnosed. Two years after the eyes became involved, the skin showed patches of depigmentation. The anterior part of the uvea was only slightly involved; the vitreous of both eyes contained diffuse opacities consisting of powderlike pigment par-

ticles. The disease recurred at irregular intervals, and reduced the visual acuity of the right eye to 3/50, and of the left to 3/10. The authors concluded that the disease was a transition between Vogt-Koyanagi's and Harada's disease. A virus, similar to, or identical with, herpes virus, could produce the vitiligo by invading the terminal branches of the cutaneous nerves and also might produce the ocular lesions. It could likewise be assumed that an allergy of the skin was associated with a hyperergy of the eyes or that pigment-dissolving antibodies might have been formed in the uvea. (1 photograph, references.)

K. W. Ascher.

Valero, M. Neuroparalytic keratitis and heterochromia in syringomyelia. *Rassegna Ital. d'Ottal.*, 1942, v. 11, Nov.-Dec., p. 435. (See Section 6, Cornea and sclera.)

8

GLAUCOMA AND OCULAR TENSION

Bárány, E. The influence of local arterial pressure on aqueous humor and intraocular pressure. An experimental study of the mechanisms maintaining intraocular pressure. *Acta Ophth.*, 1946, v. 24, pt. 4, pp. 337-387.

This is a detailed report of a comprehensive investigation on rabbits, in an effort to demonstrate the presence of hemostatic reflexes which control the intraocular pressure. The tension of the eyes of rabbits with a van Leersum carotid loop was measured with a tonometer under local anesthesia, from a few seconds to three hours after clamping the loop. The difference in the pressure of the two ophthalmic arteries caused by the unilateral carotid occlusion was estimated from the difference in the peripheral pressure between the

two halves of the head; this was determined by compression of the two central arteries of the ear of the moderately heated unanesthetized animal. That a direct correlation exists between the two pressures was shown by a direct determination of the pressures in the ophthalmic arteries. The absolute difference between the ophthalmic artery pressures is greater than the difference between the ear artery pressures, but the ratios are approximately equal. The graphic data show that on closure of the carotid the mean blood pressure in the ear artery drops to one third of the starting level, but recovers rapidly during the following few minutes, and after 10 minutes keeps a constant level of about one half of the pressure on the other side. This level is maintained for at least one hour. At the same time the intraocular pressure gradually drops by about 4 mm. Hg during the first two seconds, and about $\frac{1}{2}$ mm. during each subsequent second. During the following few minutes there is a partial recovery. On the average the intraocular pressure drops about 3.5 mm. Hg within three minutes after the carotid is closed. There is no sudden change of the curve to indicate the existence of a reflex that quickly regulates intraocular pressure. On the contrary, the extent and the rate of recovery of the intraocular pressure closely corresponds to the recovery of blood pressure. During the hours following carotid closure the intraocular pressure remains at a constant level of about 3 to 3.5 mm. Hg below that of the control eye. There is no indication of a regulating reflex of slow action.

Ray K. Daily.

Bozzoli, Alessandro. Perforating diathermy coagulation of the corneoscleral limbus in ocular hypertension. *Riv. di*

Oftalm., 1946, v. 1, Sept.-Oct., pp. 631-633.

This preliminary note reports a new procedure used in ten cases of ocular hypertension. After retrobulbar anesthesia, a small conjunctival pocket is undermined beginning $1\frac{1}{2}$ cm. above the limbus. Every bleeding vessel is electrically coagulated to avoid hemorrhage. The electric needle is used to penetrate the limbus in the same direction as one would enter with a keratome to perform a paracentesis. As soon as the needle enters the chamber (amperage not indicated) aqueous humor will escape and a few bubbles will form in the chamber. A peripheral iridectomy can be performed with the needle or can be added separately. The postoperative course was uncomplicated and the intraocular pressure remained normal for many months. The advantages of the operation are its simplicity, cleanliness, and absence of hemorrhage. No lens opacities were observed.

K. W. Ascher.

Cristini, Giuseppe. Clinical considerations on the action and effects of X-ray therapy on spinal sympathetic centers and superior cervical ganglion of normal and glaucomatous eye. *Riv. Oto-Neuro-Oft.*, 1946, v. 21, May-Aug., pp. 199-225.

The author tested the effect of Roentgen irradiation of the spinal cord and the superior cervical ganglion in 15 patients some of whom had normal eyes others latent or well developed glaucoma. Eleven of the patients were men and four women and they ranged in age from 32 to 73 years. The results are given in tabular form. In glaucoma the sympathetic vegetative regulation is depressed. The writer emphasizes the importance of this new therapeutic procedure to reduce the increased intra-

ocular tension temporarily. (Bibliography.) Melchiorre Lombardo.

Louhela, T., and Teräskeli, H. On the results of different glaucoma operations. *Acta Ophth.*, 1946, v. 24, pt. 1, pp. 27-43.

A brief review of the Scandinavian literature on antiglaucomatous operations is given, and an analysis of the results of 520 operations on 474 eyes is made. This is the material of the Helsinki Hospital for the years 1930 to 1942. The data are tabulated. In acute glaucoma iridectomy is the procedure of choice. A comparison between the results of cyclodialysis and iridencleisis takes into account the effectiveness of the procedure, and the complications incident to it. Of the two procedures cyclodialysis has proved more effective in reducing tension. The most feared complication of antiglaucomatous operations, which is cataract, does not occur immediately in cyclodialysis. It occurred once in 206 cases and was the result of faulty technic. In iridencleisis this complication does occur. If the time of observation is sufficiently long, however, cataract is encountered with about equal frequency after both operations. Impairment of the visual function, in the absence of cataract, is more frequent following cyclodialysis, and the end results are therefore slightly better after iridencleisis. It is difficult to determine to what extent these degenerative changes are due to the disease itself, and to what extent to surgery. The authors suggest that perhaps the sensitive uvea is subjected to more damage in cyclodialysis than in iridencleisis. (6 tables.) Ray K. Daily.

Sjögren, Henrik. A study of pseudoglaucoma. *Acta Ophth.*, 1946, v. 24, pt. 3, 239-294.

This term is applied by Thiel to glaucoma without increased ocular tension. A comprehensive review of the literature, and brief reports of nine cases of glaucoma without hypertension show that every conceivable combination with and transition to glaucoma have been described. Glaucoma without hypertension can pass over into hypertension and vice versa. Glaucoma can be present without hypertension in one eye, and with it in the other; in unilateral glaucoma the tension may be higher than in the normal eye without exceeding the normal limits or may be equal and normal in both eyes, or may even be lower in the diseased eye. In unilateral glaucoma the tension may rise in both eyes, and in bilateral glaucoma the tension may rise in one eye only; occasional rises of tension may occur in pseudoglaucoma. Acute inflammatory phenomena may develop without increase in tension, or with a slight rise that does not exceed the physiologic limits. Eyes with normal tension may exhibit occasional rises during the day, or in response to provocation. The disease may be familial, or one member of the family may have glaucoma with hypertension, and another without. After surgery, glaucoma can progress as glaucoma without tension. The pathologic changes and the functional disturbances are the same in glaucoma with and without hypertension. The pathologic picture is similar to that in cerebral atrophy; glaucoma and the brain changes may occur simultaneously in the same person. The depth of the excavation of the optic nerve has no relation to the height of the pressure and it is frequently deeper in glaucoma without tension; a high tension may exist a long time without the occurrence of excavation of the

disk. It is suggested that glaucoma with and without hypertension are the same disease, and that the term pseudo-glaucoma be reserved for congenital anomalies or pressure atrophies simulating glaucomatous excavation. The author agrees with those who hold that the basis of glaucoma is a circulatory disturbance independent of intraocular pressure. The disturbance of vascular function may produce glaucoma with hypertension, glaucoma without hypertension, and cerebral atrophy. If the disturbance involves the anterior part of the eye the result is an anterior glaucoma with hypertension; if it is located in the posterior portion of the eyeball the clinical manifestation is posterior glaucoma without hypertension; if it is located in the brain it leads to cerebral atrophy. The reported cases show that these processes may occur singly or in combination. (33 visual fields and tension curves.) Ray K. Daily.

Weekers, L., and Weekers, R. A new contribution to nonperforating cyclodiathermy in the various forms of glaucoma. *Acta Ophth.*, 1946, v. 24, pt. 1, pp. 1-24.

In this exhaustive presentation the authors review the history of the application of cyclodiathermy for glaucoma, and the technic is described. Application of the electrode over the conjunctiva results in conjunctival burns somewhat larger than the electrode, at the bottom of which one sees the apparently uninjured sclera. A detailed analysis of 76 cases of various types of glaucoma thus treated shows the effect of the procedure on the eye. Histologic sections of enucleated eyes shows that the dominating process after cyclodiathermy is an enormous vasodilatation in the uvea, followed by exudation.

Four months later an eye showed a slow cicatricial process with atrophic areas in the ciliary body. Cyclodiathermy is believed to result in a change in the equilibrium between the production and resorption of fluid, in the eye, in favor of greater resorption. The hypotonizing effect of cyclodiathermy is constant and pronounced. The operation is indicated in chronic glaucoma in which other operations have failed, and it is the operation of choice in absolute glaucoma. It is effective in the various types of secondary glaucoma. In acute glaucoma its hypotensive effect is marked but transitory.

Ray K. Daily.

Zaretskaya, P. B. The effect of electric stimulation on ocular tension. *Amer. Jour. Ophth.*, 1947, v. 30, May, pp. 489-590. (2 figures, 2 references.)

Zondek, H., and Wolfsohn, G. Primary glaucoma and the pituitary-diencephalic system. *Amer. Jour. Ophth.*, 1947, v. 30, May, pp. 596-600. (10 references.)

9

CRYSTALLINE LENS

Arruga, H. Mishaps and complications in the cataract operation. *Ophth. Ibero Amer.*, 1946, v. 7, no. 4, pp. 275-280.

The author deals with the various difficulties under the following headings: blepharospasm, small cornea, shallow anterior chamber, friable conjunctiva, emptying of the anterior chamber, hemorrhage into the anterior chamber, ocular hypertension, vitreous in the anterior chamber, anterior synechia, posterior synechia, intumescent cataract, resistant zonula, rupture of the zonula, escape of vitreous, expulsive hemorrhage. W. H. Crisp.

Di Ferdinando, R. Etiologic relationship between juvenile cataract and war conditions. *Riv. di Oftalm.*, 1946, v. 1, Sept.-Oct., pp. 617-630.

The eyes of six soldiers with bilateral lens opacities are described. Three had posterior subcapsular opacities, three had punctate opacities of the coronary type. Psychic trauma, vitamin deficiency, and neuro-humoro-hormonal imbalance may have been the cause of the opacities. (4 figures, bibliography.)
K. W. Ascher.

Huggert, A. The thickness of the cortex of the crystalline lens in different ages. *Acta Ophth.*, 1946, v. 24, pt. 1, pp. 43-62.

The article includes a comprehensive review of the literature, and a report of original investigations on 303 experimental subjects in an attempt to measure the absolute axial thickness of the cortex of the lens at different ages. The method of using Lindstedt's apparatus with slit-lamp illumination, and the subsequent calculations are described in detail. The distances measured were from the surface of the cornea to the anterior surface of the lens; to the anterior surface of the adult nucleus; to the posterior lens pole; and to the posterior surface of the adult nucleus. The data are reported graphically. The thickness of the anterior lens cortex is relatively similar at all ages, and increases by about 0.007 mm. per annum; the calculated thickness of the posterior cortex is probably the same. The size of the adult nucleus appears to be unchanged throughout the years.

Ray K. Daily.

Huggert, A. Are the discontinuity zones of the crystalline lens iso-indicial surfaces? *Acta Ophth.*, 1946, v. 24, pt. 4, pp. 417-421.

With a refractometer Huggert examined samples of lens substance that had been removed under slit-lamp observation from various areas of a zone of optical discontinuity. The results indicate that the zones of discontinuity are iso-indicial surfaces.

Ray K. Daily.

10

RETINA AND VITREOUS

Alvaro, M. E. Use of roentgen rays in treatment of retinal disorders characterized by new formation of vessels—Eales disease, arteritis, periphlebitis and endophlebitis, proliferating retinitis. *Rev. Brasileira de Oft.*, 1946, v. 5, Dec., pp. 71-87.

The author discusses at some length the probable effect of X rays upon the capillary circulation, as studied by various writers on radiology. The hematopoietic organs are extremely sensitive to X rays. Moderate doses cause immediate dilatation of the capillaries. The action of the rays may also include a greater permeability of the endothelium. Conflicting results stated by different authors arise from wide variation in the dosage employed, but there is more or less unanimity in the opinion that the dosage should be very small, always less than one skin erythema dose, and in most cases not more than one half of this dose, generally administered in fractions. According to Alvaro, the hard rays should be employed. Clinical experience over several decades appears to justify the employment of X rays in the treatment of the conditions mentioned in the title. (Bibliography.)
W. H. Crisp.

Arruda, Jonas de, and Sebas, S. R. Degenerative macular disorders. *Rev. Brasileira de Oft.*, 1947, v. 5, March, pp. 135-155.

A study of the literature leads the author to suggest that these lesions be classified into two main groups, acquired and hereditary, with six subdivisions: (1) acquired; central recurring retinosis, exudative macular retinosis, and cystoid degeneration of the macula; (2) hereditary; hereditary degeneration of the macula, colloid hereditary degeneration of the macula, and macular degeneration in familial amaurotic idiocy. (5 illustrations reproduced from other authors; short bibliography.)

W. H. Crisp.

Drualt, A., and Drualt, S. Anterior limits of the retina. *Ann. d'Ocul.*, 1946, v. 179, Oct., pp. 531-539.

The anterior attachment of the retina is not concentric with the corneal limbus, but slightly more forward on the nasal side, which facilitates the larger temporal visual field. Nasally the retina extends to within 8 mm. of the corneal limbus and temporally to about 10 or 12 mm. Retinal function extends forward to approximately the level of the ocular nodal point which corresponds with the center of the lens. This is of importance in the surgery of retinal detachment. In section, the retina is approximately two thirds of a circle, and is attached firmly only at the ora serrata and the optic nerve. Peripherally the proportion of rods to cones is approximately 20 to 1. (17 references.)

Chas. A. Bahn.

Falls, H. F. Inheritance of retinoblastoma, two families supplying evidence. *Jour. Amer. Med. Assoc.*, 1947, v. 133, Jan. 18, pp. 171-174.

Two pedigrees are presented to support the contention that retinoblastoma is a hereditary form of neoplasia. In one family bilateral retinoblastoma occurred in each of a pair of "single

cord" female identical twins, the third such pair in the literature. The tumors were noted at the age of six months, and both infants quickly died. In the other family the mother of a child with retinoblastoma had an enucleation of her left eye at the age of 3½ years because of retinoblastoma. Five of the nine siblings of the mother's generation had diagnoses of retinoblastoma, and two of these survived to reach child-bearing age. This pedigree adds to the list of reported observations of the "vertical transmission" of the neoplasm. The author strongly feels that parents of a child who develops retinoblastoma should have no more children, and that any survivor of enucleation for retinoblastoma should be sterilized. (2 figures, abstract of discussion.)

Bennett W. Muir.

Gordon, D. M. The treatment of retinitis pigmentosa with special reference to the Filatov method. *Amer. Jour. Ophth.*, 1947, v. 30, May, pp. 565-579. (1 table, 39 references.)

Gördüren, Süreyya. A Grönblad-Strandberg syndrome. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 228-232.

The author discusses the literature and presents an interesting case of Grönblad-Strandberg syndrome, with the two components of the disease, angioid streaks and pseudo-xanthoma elasticum, clearly demonstrated. Angioid streaks, which are due to the widespread degeneration of elastic tissue were present in both eyes. A large yellow raised mass was present in the posterior pole of one eye. The skin of the neck and abdomen had a parchment-like appearance with raised yellow streaks. Microscopic examination of the skin in biopsy, showed degeneration of the elastic elements. (7 illustrations.)

O. H. Ellis.

Holm, Stig. Macular proliferation (pseudotumor) and closely related pictures of disease (retinitis circinata, Coats's disease, etc.) *Acta Ophth.*, 1941, Supplement 18.

The cases of macular proliferation and borderline cases, and the reported cases of retinitis circinata that have been examined histologically are reviewed. A clinical, ophthalmologic, and histologic description is given of a case of macular proliferation in the form of a pseudotumor, which presented the picture of retinitis circinata, in a woman 82 years of age. The pseudotumor was twice as large as the largest pseudotumor that has been reported. A case of a subretinal hemorrhage with macular proliferation is also reported. An analysis of this material suggests that an activation of the pigment epithelium layer of the retina is the primary cause of the development of pseudotumor. This activation may have induced the intense proliferation of pigment cells. It seems probable that the pigmented epithelium is responsible for the new formation of connective tissue. The ganglion cell layer was found intact, which accounts for the absence of changes in the optic disc. The histologic basis of retinitis circinata is not definite; the ophthalmoscopic picture of retinitis circinata may be caused by intraretinal changes, by subretinal accumulation of fluid, and by newly formed subretinal connective tissue and subretinal degenerated pigment epithelium. The review of the literature shows that ophthalmoscopically and histologically the picture of macular proliferation may also be seen in angiomas of the retina, in the macular changes in angioid streaks, in exudative macular juvenile retinitis, and in chronic central retinochoroiditis. The

soft membranes of the eye seem to react in the same manner to different pathologic agents. The differential diagnosis from a malignant tumor is very difficult, and transillumination does not give definite data. (12 photomicrographs, 6 fundus photographs.)

Ray K. Daily.

Kaminskaya-Pavlova; Z. Pathogenesis of fundus changes in skull injuries. *Amer. Jour. Ophth.*, 1947, v. 30, May, pp. 613-615.

Longhena, Louisa. Gangliectomy for treatment of retinosis pigmentosa. *Riv. Oto-Neuro-Oft.*, 1943, v. 3, May-June, pp. 135-153.

Resection of the stellate ganglion of the sympathetic was performed in seven patients suffering from retinosis pigmentosa. In one the operation was performed bilaterally. In three patients, no improvement of the visual function was observed and in one, a slight improvement occurred; In three other patients, the visual acuity was increased distinctly after the operation, and in two of them the visual fields were less constricted after the operation. Dark adaptation also was improved in some of the patients. Early operation is advocated to preserve what is left from the slowly degenerating retinal tissue. After the operation, ptosis and miosis become obvious and persist for an indefinite period; conjunctival hyperemia is always present; the retinal vessels are dilated for months in some patients, but in others the vascular diameter does not seem to be markedly greater in the eye of the operated side. Moderate headaches, pain in the neck and in the shoulder were observed occasionally; in two patients, a permanent hoarseness followed the operation.

K. W. Ascher.

Schneider, R. W., McCullagh, E. P., Ruedemann, A. D., Kennedy, R. J., and Lewis, L. A. Hemorrhagic diabetic retinitis; a method of treatment based on the elevation of plasma albumin by diet. *Cleveland Clin. Quart.*, 1947, v. 14, April, pp. 76-80.

In patients with diabetic retinitis, plasma proteins are normal or slightly reduced in quantity and there is a relative decrease of albumin and increase of beta globulin. Plasma albumin levels in this group are not readily corrected, and 100 to 200 grams of protein per day for many months are necessary to decrease the tendency to exudation and hemorrhage. Of 16 patients observed for two to three and a half years the plasma protein pattern was corrected and the recurrent hemorrhages disappeared in six, and were decreased in one.

Irwin E. Gaynon.

Paez Allende, F. A case of arachnodactyly, or Marfan's disease, with subluxation of both lenses and high myopia. *Anales Argentinos de Oft.*, 1946, v. 7, July-Aug.-Sept., pp. 81-85.

This typical syndrome consists of elongated stature, long extremities with fine, elongated, spidery fingers and toes, muscular hypotony, easy dislocation of body joints, luxation or subluxation of the lenses, myopia, and various other secondary derangements, physical and mental. The etiology and pathogenesis cover the fields of toxic states, muscular dystrophy, atavisms, primary hormonal disease, and disturbances of the nervous system. In the presentation of the author's case, a seven-year-old girl, the following features were of diagnostic importance: height greater than normal for her age, asthenia, melancholy facies, long, tapering fingers, left partial heterochromia iridis, bilateral

iridodonesis, bilateral nasal subluxation of the lenses, and over twenty diopters of myopia. (Bibliography.)

Edward Saskin.

Weinstein, P., and Forgács, J. Circulatory studies of the fundus of the eye. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 238-242.

Patients with spontaneous venous pulsation of the blood vessels of the fundus have a better retinal circulation and have 50 percent less retinal complications than persons without pulsation. In patients with pulsation the pressure drop from the arterial to the venous circulation is greater; without pulsation the arterial pressure is established at a higher level which signifies capillary obstruction. Spontaneous venous pulsation disappears with the reduction of intraocular tension by massage of the globe. O. H. Ellis.

13

EYEBALL AND ORBIT

Azzolini, Umberto. Orbital angioma. *Riv. Oto-Neuro-Oft.*, 1943, v. 3, May-June, pp. 184-198.

A 42-year-old woman had suffered from headaches for years, and noticed protrusion of her left eyeball and increasing diplopia for the past two years. An unreducible proptosis was found and the external rectus muscle of the left eye was paretic. Radiologically an opaque region was found in the left orbit, and a Kroenlein operation was performed, with the tentative diagnosis of meningioma. A cavernous angioma was found. The postoperative course was complicated by a hemorrhage into the tip of the orbit, which slowly was reabsorbed. (7 figures.)

K. W. Ascher.

Babel, J. Orbital chronic inflammation and pseudo-tumors. *Ann. d'Ocul.*, 1946, v. 179, Oct., pp. 540-550.

Many years ago Birch-Hirschfeld divided slow space-taking orbital lesions with slight or no inflammatory reaction into three groups: 1. those which disappeared after nonspecific therapy; 2. those which contain diffuse chronic inflammatory tissue; 3. those characterized by the formation of lymphoid and degenerative vascular changes.

A 62-year-old woman had a slight recurrent inflammation of the lids and orbit with exophthalmos during a period of 20 years. Ocular movements were limited in all directions. Upon exploration, a mass of inflammatory tissue was removed from the orbit which consisted essentially of dense cicatricial tissue. Orbital radiography showed erosion and diffuse osteoporosis of the superior external border of the left orbit that suggested a neighboring inflammatory process. This case conformed to Birch-Hirschfeld's class 2.

A 22-year-old woman had a slight ptosis, and a hard tumor that involved the upper external angle of the orbit. Otherwise both eyes were normal and had normal vision. A rounded mass was removed which included a part of the lacrimal gland. The pseudotumor was considered secondary to dental infection.

The third patient was a woman, 67 years of age, who had developed an almond-sized painless mass in the right orbit near the superior external angle during the previous year. Otherwise both eyes were normal except for a senile macular degeneration. Under the orbitotarsal fascia an extremely friable and unencapsulated tumor was removed. This consisted largely of lacri-

mal gland with chronic inflammatory changes. (17 references.)

Chas. A. Bahn.

Bey, Handousa. Some observations on the symptomatology and diagnosis of cases of proptosis. *Brit. Jour. Ophth.*, 1947, v. 31, March, pp. 155-160.

Bey reports his experience with proptoses. The largest number, 31, originated from intraorbital lesions such as inflammation, cysts, and neoplasms. A few were secondary to diseases of the paranasal sinuses, and a small group were caused by traumatic, inflammatory, and neoplastic changes in the bony wall of the orbital cavity.

Morris Kaplan.

Delsores, Jose. Orbital phlegmon treated with sulfanilamide. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, July, pp. 673-675.

The patient was given five grams of Leuco-tiazol by mouth daily during the first four days (0.5 Gram every two hours) and four Grams daily the next three days. At the end of the eighth day the inflammation had subsided. The above dosage was sufficient to keep the blood concentration of the drug at the effective level.

J. Wesley McKinney.

Esente, Ivan. Radiologic and histologic study of two eyeballs containing ossifications. *Riv. di Oftalm.*, 1946, v. 1, Sept.-Oct., pp. 604-616.

Comparison of radiograms and microscopic sections of two atrophic eyes proved the value of radiologic examination for diagnostic purposes. The bony tissue was derived directly from the connective tissue. (10 pictures, bibliography.)

K. W. Ascher.

Forbes, S. B. Exophthalmos in relation to orbital tumors; report of eight cases. *South. Med. J.*, 1947, v. 40, March, pp. 206-213.

This is a report of eight cases of unilateral exophthalmos. In four the proptosis resulted from a primary orbital tumor, in three from a tumor outside the orbit, and in one from a primary pseudotumor. A lipoma was not changed by irradiation, and transconjunctival surgery was done. Now there is a slight enophthalmos. A squamous cell carcinoma occurred about the left orbit and sphenoidal ridge (presumably metastatic, though the primary focus was not found), and the patient died about nine months after the eye had begun to protrude. A third patient had a pyocoele of the ethmoid which was treated surgically with success. A mucocoele of the ethmoid was similarly treated with an excellent result. The fifth patient developed exophthalmos after a second thyroidectomy. A Krönlein operation was done. The lateral and inferior muscles were very large. A pseudo-tumor receded after irradiation in fractional doses. The other two cases resulted from benign cavernous hemangiomas; in both a Krönlein operation was done, with good results. (12 photographs.)

Bennett W. Muir.

Kestenbaum, Alfred. A new principle of relative exophthalmometry. *Confinia Neurologica*, 1946, v. 7, no. 3-4, pp. 113-120.

While the patient is looking upward, a ruler is held horizontally in front of and parallel to the patient's face. The inferior edge of the ruler is on the same level as the lowest point of the limbus. The distance between the limbus and ruler is equal to the width of the ruler.

The observer looks over the ruler's upper edge and brings his head to a level where he sees the left inferior edge of the patient's limbus with his right eye, aligned with the upper edge of the ruler. Then he looks at the other eye without changing position. If relative enophthalmus is present, a strip of sclera will be visible above the edge of the ruler. The measurable strip of visible sclera equals the degree of relative enophthalmus. (2 figures.)

Irwin E. Gaynon.

Moreira de Andrade, Luiz. General considerations on a case of traumatic pulsating exophthalmos. *Rev. Brasileira de Oft.*, 1947, v. 5, March, pp. 171-178.

A youth aged 16 years received a violent blow on the head from the door of a bus in which he was riding, and was taken unconscious to the hospital. There was a fracture in the right temporo-parietal region, disclosed by X ray. Examination showed moderate exophthalmos on the right side, reduced movement of elevation of this eye, and homonymous diplopia. Both external rectus muscles were inactive, and there was a distinct Babinski reflex on the left side. Some weeks later the patient complained of intense headache and a buzzing. The conjunctival vessels were considerably disturbed, there was considerable chemosis in each eye, and exophthalmos in each eye but especially the right. Vision was right $\frac{2}{3}$, left 1. Pulsation was noticeable on palpation on each side, and a bruit was audible through the stethoscope, especially on the right side. Improvement followed ligation of the right common carotid. (References.)

W. H. Crisp.

Seidenari, Renato. Two typical cases of Charlin's syndrome. *Riv. Oto-*

Neuro-Oft., 1943, v. 3, May-June, pp. 177-183.

In 1930, Charlin described a syndrome that consists of alterations of the sensibility (pain in the nasal upper orbital angle, in the ala nasi, and in the eye), of the lacrimal secretion (rhinorrhea) and of the sudoriferous glands (hyperhydrosis), vasomotor changes (hyperemia) in the conjunctiva and the nasal mucous membranes, and trophic changes in the cornea (small ulcers) and in the iris (iritis). Nasal therapy with cocaine and adrenaline solution brought relief in two cases observed by the author. (Bibliography.)

K. W. Ascher.

Vances, P., Ianou, A., and Metianu, I. Subacute staphylococcal septicemia with severe orbital maxillary symptoms cured by penicillin. *Ann. d'Ocul.*, 1946, v. 179, Oct., pp. 511-523.

A five-weeks-old infant with facial pyoderma since birth developed severe palpebral and conjunctival edema with exophthalmos, a seropurulent nasal secretion, a slight deformation of the palate and severe febrile symptoms. During the following ten days the ethmoids were curetted and the lower temporal portion of the orbit was drained. Penicillin (50,000 units) was injected into the orbital tissues. The ocular symptoms greatly improved until the eighteenth day when a recurrence began. The orbital wound was drained, penicillin (10,000 units) was immediately injected into the orbital tissues, and one half of the quantity was injected every three hours. One week later the patient was practically well. The authors believe that the lesion was the result of a staphylococcic septicemia that resulted from the facial pyoderma. Staphylococci were identified by stain-

ing and culture in the affected tissues. A constitutional predisposition (lymphatic exudative diathesis) made possible the secondary staphylococcal infection that rapidly extended into the nose, paranasal sinuses, and orbit. (51 references.)
Chas. A. Bahn.

14

EYELIDS AND LACRIMAL APPARATUS

D'Eramo, C. Congenital fistula of the lacrimal canal. *Anales Argentinos de Oft.*, 1946, v. 7, July-Aug.-Sept., pp. 79-80.

A five-year-old child is presented who had tearing of the left eye since birth, and a small discharging orifice about five millimeters below and internal to the inner canthus. Exploration of the orifice by irrigation showed that fluid entered the sac and appeared at the inferior nasal meatus. The author felt the fistula was congenital and he contemplated surgical extirpation. (1 radiograph.)
Edward Saskin.

Kiskadden, W. S., and McGregor, M. W. Coloboma of the eyelids. *Plastic and Reconstructive Surg.*, 1947, v. 2, Jan., pp. 60-65.

The authors present a case of congenital coloboma of the inner portion of each upper eyelid in an infant, one of unidentical twins, aged one week. Boric acid irrigations and ointment did not prevent some corneal ulcerations although thorough care was given by the infant's mother, a nurse. When the child was 2½ months of age, surgery was performed. The technique, as well as that of Falchi, Wicherkiewicz, Peer, and Hughes is described. The original corneal scarring has largely disappeared and it is believed that little permanent defect will result.

Francis M. Crage.

Landau, J. A case of congenital vertical shortness of the lids combined with tetrastichiasis. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 219-222.

The author reviews the literature, and presents an unusual case of congenital vertical shortness of the lids. The patient also had tetrastichiasis, combined with a partial eversion of the cutaneous part of the upper lid margin. It appeared that the hair follicles of the supernumerary cilia had taken the place of the Meibomian glands, and occupied their ducts. No inflammation of the eyes had occurred.

O. H. Ellis.

Harms, H. H., and Ryerson, F. L. Coloboma of optic nerve. *J. Michigan M. Soc.*, 1947, v. 46, Feb., pp. 214-215.

The authors describe a coloboma of the left optic nerve in a 51-year-old Negro woman. The findings were negative except for a four-disc-diameter excavation that is 12 diopters deep. The deepest inferior portion is blue white, and the area above is bluish pink, and has a veil. The vessels bend sharply over the inferior margin of the disc. The superior portion of the optic disc is normal. Central field studies revealed an enlarged blindspot.

Irwin E. Gaynon.

Price, H. W. Dacryostenosis. *J. Pediat.*, 1947, v. 30, March, pp. 302-305.

Of 203 infants with dacryostenosis 192 recovered with conservative therapy which consisted of irrigation of the eye with boric acid solution and pressure over the lacrimal sac. The latter is applied three times daily. With a rocking motion from above downwards at the inner canthus an attempt is made to expell the contents of the sac through the nasolacrimal duct into the nose.

Irwin E. Gaynon.

Seidenari, Renato. Study of the bony part of the nasolacrimal duct and of the nasal mucous membrane surrounding the orifice of the nasolacrimal duct. *Minerva med.*, 1947, v. 1, Feb. 10, pp. 176-181.

Investigations of the nasal mucous membranes and the bony ducts of four corpses showed that dacryocystitis need not be connected with inflammatory disease of the nasal mucosa surrounding the orifice of the nasolacrimal duct. There is, however, a narrowing of the bony ducts and a more winding course than in individuals not affected by dacryocystitis. The veins of the mucous membrane of the duct form a dense network, almost an erectile tissue according to Magitot; slight nasal congestion may suffice to bring the mucous membranes of the nasolacrimal duct into apposition, which may be followed by permanent adhesions. Narrowing of the duct, as found in the specimens described, is a contributory factor. If the nasal disease recurs, another adhesion may form above and below the first one. The nasolacrimal ducts of persons without dacryocystitis are wider and less winding. (9 figures.)

K. W. Ascher.

Seidenari, Renato. Histopathology of the nasal mucous membrane adjacent to the os unguis in dacryocystitis. *Minerva med.*, 1947, v. 1, Feb. 10, pp. 181-186.

Ten cases of dacryocystitis were used for a study of the mucous membranes obtained during dacryocystotomy. Special attention was devoted to the epithelial cells, the cellular infiltration, and to the vessel walls of the region possibly responsible for the development of the dacryocystitis such as the ethmoidal anterior sinus. In eight patients the findings were completely normal only two specimens were characterized by

definite inflammatory changes. (6 figures.)
K. W. Ascher.

Spaeth, E. B. Correction of some forms of acquired ptosis. Plastic and Reconstructive Surg., 1947, v. 2, Jan., pp. 37-43.

The greater number of cases of acquired ptosis fall into three surgical subdivisions. In the Hess technique the resultant cicatricial bands bring the desired result; in the Reese technique the orbicularis is utilized; and in the third a classical advancement of the levator is combined with the resection and tarsectomy to increase the effectiveness of the levator.

The Hess procedure is indicated in the correction of ptosis associated with any type of lid reconstruction. Acquired ptosis where trauma has produced thick, ptotic lids and cicatrices, and where little orbicularis action remains, calls for the Hess operation. Where trauma has severed the levator, the orbicularis should be transplanted into the occipitofrontalis muscle. If the orbicularis is destroyed a transplant of fascia lata may be made. When the levator is only partially severed, reattachment is not difficult.

Surgical suggestions are made for the treatment of other anatomic defects associated with acquired ptosis. Five cases are presented.

Francis M. Crage.

15

TUMORS

Babel, J. Orbital chronic inflammation and pseudo-tumors. Ann. d'Ocul., 1946, v. 179, Oct., pp. 540-550. (See Section 13, Eyeball and orbit.)

Laval, Joseph. Hemorrhage in sarcoma of the choroid. Amer. Jour. Ophth., 1947, v. 30, May, pp. 607-609.

(See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Reese, A. B. Pigmented tumors. (The de Schweinitz lecture.) Amer. Jour. Ophth., 1947, v. 30, May, pp. 537-565. (16 figures, 1 table, 56 references.)

16

INJURIES

Arentsen, Juan. A case of sympathetic ophthalmia cured with penicillin. Arch. Chilenos de Oft., 1946, v. 2, March-April, pp. 118-123.

The patient was a boy of 12 years, injured in the right eye with a dynamite cap. The penetrating corneal wound was badly infected, and the condition improved rapidly under penicillin given locally and generally. It is difficult to understand why the author speaks of a case of sympathetic ophthalmia, since the injury had occurred only five days earlier, and the left eye remained completely healthy.

W. H. Crisp.

Vail, Derrick. Early treatment of ocular injuries. Industrial Med., 1947, v. 16, April, pp. 173-174.

The author appeals to the industrial surgeon for early treatment of ocular injuries which rank second to none in importance. He clearly outlines the proper procedures to be used.

O. H. Ellis.

Van Arsdell, P. M. First aid for chemical eye injuries. Industrial Med., 1947, v. 16, April, pp. 188-196.

The ocular reactions to acids, alkalis and salts are extensively tabulated, and our knowledge of these effects widened. The fact is stressed repeatedly that no treatment of chemical eye injury compares with immediate copious irrigation with water. This is the most effective first-aid measure.

O. H. Ellis.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. Edgar Leonard Goodman, Washington, D.C., died February 28, 1947, aged 44 years.

Dr. John Greenwood Jennings, Boston, Massachusetts, died February 17, 1947, aged 58 years.

Dr. Frederick Manwaring Law, New York, New York, died February 12, 1947, aged 71 years.

Dr. Walter Ivan Lillie, Philadelphia, Pennsylvania, died February 21, 1947, aged 55 years.

MISCELLANEOUS

EYE-BANK FOR BOSTON

An affiliated Eye-Bank has been organized in Boston and is ready to serve the needs of New England. It is located in the Massachusetts Eye and Ear Infirmary building at 243. Charles Street. Seven hospitals in the Boston area and one in Maine have already become affiliated with it. The general public in New England is being urged to sign forms, available from the Boston Eye-Bank, indicating their willingness to donate their eyes for use after death.

Henry Hixon Meyer, William S. Ballard, and Dr. Edwin B. Dunphy constitute the executive committee of the Boston Eye-Bank's Board of Sponsors. The board includes leading ophthalmologists throughout New England; business, industrial, and religious leaders; and representatives of the eye departments of various hospitals in the area.

STUDY COUNCIL COURSE

On June 20th the summer course in ophthalmology given under the auspices of the Ophthalmological Study Council opened at Westbrook Junior College, Portland, Maine. The course, which will run until September 13, covers such subjects as anatomy, pathology, bacteriology, physiologic optics, neuro-ophthalmology, surgical principles, glaucoma and general diseases, and ophthalmoscopy. There is laboratory work in pathology and optics and practical work in slitlamp, perimetry, and refraction.

TRAIN MOTHERS OF BLIND CHILDREN

The Iowa State Commission for the Blind is planning to offer a week of training for mothers with visually handicapped children under the age of five years. It will be held at the Iowa School for the Blind at Vinton. Designed to

acquaint mothers with the type of training which will be beneficial to their children, the course consists of a preschool training program. There is to be no registration fee, and board and room will be provided for both mothers and children. Matrons will look after the children while the mothers attend the meetings. Further information may be obtained from Mr. Leslie M. Hays, Superintendent, Iowa School for the Blind, Vinton.

EYE-BANK FELLOWSHIPS

Seven fellowships for research and 16 scholarships for its training course have been granted during the past year by The Eye-Bank for Sight Restoration, Inc. Physicians from other countries who have received awards include: Dr. John P. Blum, Geneva, Switzerland; Dr. Walter Kornbleuth, Jerusalem; Dr. Geminiano de Ocampo, Manila; Dr. M. K. Yuo, Fukien, China; Dr. P. K. Kuo, Shanghai; and Major M. M. A. Dubash, Bombay, India.

SOCIETIES

ANTIBIOTIC THERAPY DISCUSSED

The Reading Eye, Ear, Nose and Throat Society and the Reading Dental Society met jointly on May 21st. The speaker was Dr. John A. Kolmer of Philadelphia. His topic was "Antibiotic Therapy in Relation to Dentistry and Ophthalmology."

NEW OFFICERS ELECTED

At the May 5th meeting of the Louisiana-Mississippi Ophthalmological and Otolaryngological Society at Biloxi, Mississippi, Dr. Noel Simmonds of Alexandria, Louisiana, was elected president and Dr. Edley H. Jones of Vicksburg, Mississippi, was reelected secretary. The 1948 convention will be held in New Orleans, Louisiana.

CAROLINAS TO HAVE JOINT MEETING

The second annual meeting of the North Carolina Eye, Ear, Nose, and Throat Society and the South Carolina Society of Ophthalmology and Otolaryngology will be held at the Hotel Skyland, Hendersonville, North Carolina, on September 15th to 18th. The first two days of the program will be devoted to ophthalmology, and the speakers will be Dr. Harold Brown, Dr. John H. Dunnington, and Dr. Brit-

tain F. Payne of New York, and Dr. Jack S. Guyton of Baltimore.

Information about this meeting may be obtained from the officers of either Society. Those representing North Carolina are: Dr. V. K. Hart, president, Charlotte; Dr. W. E. Brackett, vice-president, Hendersonville; and Dr. J. A. Harrill, secretary-treasurer, Winston-Salem. The South Carolina officers are: Dr. Ruskin G. Anderson, president, Spartanburg; Dr. S. Harry Ross, vice-president, Anderson; and Dr. Roderick Macdonald, secretary-treasurer, Rock Hill.

NEW YORK SOCIETY OFFICERS

The newly elected officers of the New York Society for Clinical Ophthalmology are: Dr. Daniel Kravitz, president, and Dr. Leon Ehrlich, 211 Central Park West, New York City, corresponding secretary.

MILWAUKEE HOLDS ANNUAL MEETING

The annual meeting of the Milwaukee Ophthalmic Society was held on May 27th. The following members were nominated as officers for the coming year: Dr. Frank Treskow, president; Dr. S. S. Blankenstein, vice-president; and Dr. George Dunker, secretary-treasurer. Dr. Mark Bach, Dr. J. P. Wild, and Dr. Meyer Fox were nominated as directors. Motion pictures of fishing in Canada were shown by Dr. Herbert Schmidt, and various members of the Society showed travel slides.

CHINESE SOCIETY SPEAKER

When Sir Clutha Mackenzie of New Zealand studied the problems of the blinded soldiers in China at the invitation of the Chinese government, he stopped at West China Union University and addressed a combined session of the Chengtu Ophthalmological Society and the Chengtu Eye, Ear, Nose, and Throat Society.

PERSONALS

AWARDED SILVER MEDAL

The Illinois State Medical Society has awarded a silver medal to Dr. Bertha A. Klien,

associate professor of Ophthalmology, Northwestern University School of Medicine, for the exceptional educational value of her exhibit, "Diseases of the Fundus Oculi," shown at the 1947 meeting of the Society at the Palmer House, Chicago, in May.

DR. BARKAN SPEAKS IN HOLLAND

Dr. Otto Barkan of San Francisco was the guest speaker at the annual meeting of the Netherlands Ophthalmological Society and the Society for the Prevention of Blindness in Amsterdam, Holland, on June 7th and 8th. The subject of his paper was "Glaucoma Operations."

N.S.P.B. VICE-PRESIDENT

Dr. Conrad Berens of New York City was elected vice-president of the National Society for the Prevention of Blindness at the semi-annual meeting of the board of directors.

PROFESSOR FUCHS TO LECTURE

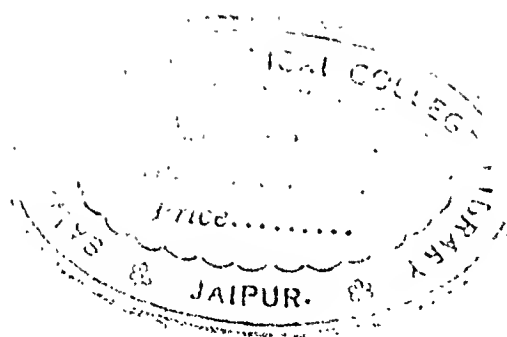
During June and July, Prof. Adalbert Fuchs of Vienna, who is visiting China under the auspices of the UNRRA, will deliver a series of lectures and conduct clinical demonstrations at the Department of Ophthalmology, West China Medical College, Chengtu, Szechwan, China.

TO GIVE DE SCHWEINITZ LECTURE

On November 20, 1947, Dr. Bernard Samuels of New York will give the 10th annual de Schweinitz Lecture before the Section on Ophthalmology of the College of Physicians of Philadelphia. Dr. Samuels' subject will be: "Necrosis of Intraocular Tissues."

MEXICAN SOCIETY SPEAKER

Dr. Joseph I. Pascal will read a paper on "Spherical Equivalent of Cross-Cylinder Tests," at the meeting of the Mexican National Society for the Prevention of Blindness to be held in Mexico City, August 11th to 15th.



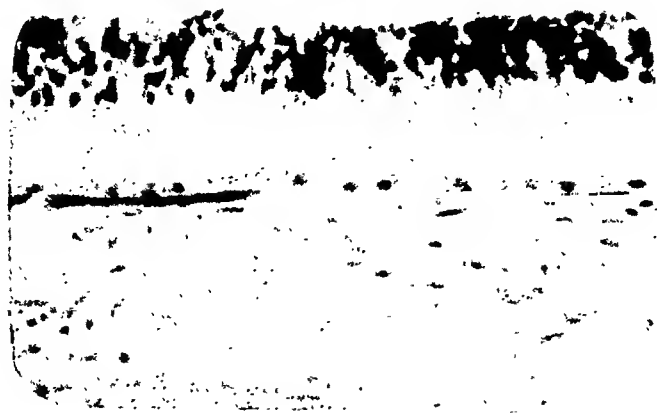


FIGURE 5

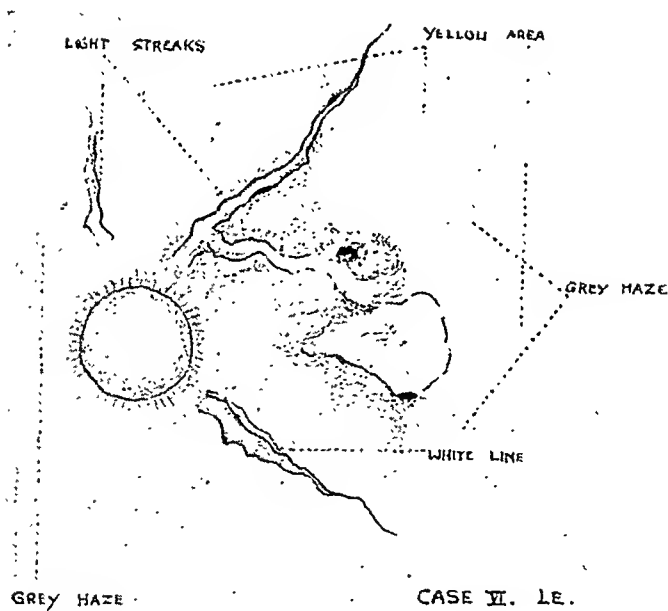


FIGURE 4

FIG. 4. (KLIEN). SKETCH OF POSTERIOR SEGMENT OF ENUCLEATED LEFT EYE OF CASE 6.

FIG. 5. (KLIEN). EARLY DEFECTS AND INTENSE STAIN OF BRUCH'S MEMBRANE. (HEMATOXYLIN-EOSIN STAIN. MAGNIFICATION X450.)

ANGIOID STREAKS*

A CLINICAL AND HISTOPATHOLOGIC STUDY

BERTHA A. KLIEN, M.D.

Chicago

Angioid streaks, like all rare lesions of the fundus, pose an especially fascinating problem in the correlation of clinical and histopathologic findings. This is the third histologic report in the ophthalmic literature, and concerns the two eyes of the same individual—one in an earlier stage, the other in a well-advanced stage of this disease—which afford an opportunity to add several new facts to the present knowledge of angioid streaks. Five clinical cases are also presented, two with associated pseudoxanthoma elasticum of the skin, and one with associated osteitis deformans (Paget's disease). Special emphasis will be placed upon the correlation of the rather varied clinical details in the different stages of the disease with the underlying histopathology.

Almost five decades of speculation about the pathologic process in angioid streaks passed between the first description of the clinical picture by O. Plange,¹ in 1891, its naming by H. Knapp,² in 1892, and the first histologic study, in 1938, by J. Boeck³ of the I. Eye Clinic in Vienna. From this first report it was obvious that one of the outstanding histologic features of this condition was breaks and dehiscences of the lamina basalis of the choroid (Bruch's mem-

brane). The conclusion, however, that these breaks and dehiscences represented the essential basis for the clinical visibility of the streaks was erroneous. Breaks in Bruch's membrane have not been unknown. They have been discovered in histologic sections of a variety of conditions such as high myopia, arteriosclerosis of the choroid, and disciform macular degeneration, in all of which only a small proportion of the breaks or none at all were visible clinically. It was realized (Hagedoorn,⁴ Klien⁵) that a mere defect in the lamina basalis alone would not be sufficient to produce the clinical picture of angioid streaks, but that something further would be necessary; that is, an alteration of the membrane which would render it opaque and make the defects visible by contrast.

Hagedoorn,⁴ in the second histologic study of angioid streaks in 1939, proved painstakingly and conclusively that there is a diffuse degeneration of the elastic fibers of Bruch's membrane, which presumably impairs its translucency and makes ruptures in the degenerated membrane visible by contrast. A suggestion of this kind, but without actual proof, had been already made by Groenblad,⁶ who emphasized for the first time that the frequent association of angioid streaks and pseudoxanthoma elasticum of the skin may point to a systemic degeneration of the elastic tissues of the body. Prior

*From the Department of Ophthalmology, Northwestern University Medical School. Read before the Chicago Ophthalmological Society, February 17, 1947.

to Groenblad's publication, this association had been noted as far back as 1903, by two French authors, Hallopeau and Laffitte,⁷ but was not further emphasized.

The clinical picture of angioid streaks has been presented so often and so well that a general description of it is omitted here. Three of the following reports of

regions appeared finely granular. The right fundus is shown in Figure 1. Between the disc and the upper portion of the circular angioid streak, there was an opaque yellowish discoloration. Within the broadest streak on the temporal side there was a fine lighter-red pattern, as if of visible choriocapillaris.

During five years of observation, there was no deterioration of the central vision. The appearance of the maculas remained unchanged, but in the inferior nasal periphery of the right eye, there developed a yellowish-gray crescentic area with discrete and confluent white dots. The visual fields revealed some enlargement of the blind spots, but were normal otherwise.

There was no pseudoxanthoma elasticum. The patient suffered from coronary vascular disease. Blood pressure was 130/80 mm. Hg.

*Case 2.** Sch. E., a woman, aged 40 years, entered the eye clinic of Rush Medical College complaining of bilateral, progressive loss of vision for the past two years, the onset of which was characterized by marked metamorphopsia. At the age of nine years, she had also noted cutaneous lesions in the form of small yellowish papules at the base of the neck. After the age of 30 years, similar lesions developed in the groins and the axillae. There was no history of ocular trauma or inflammation. The family history was irrelevant. Corrected vision was: R.E., 0.5; L.E., 0.3—1. The external ocular findings were normal, as were the optic discs and retinal vessels. In the right fundus, there was a semicircular arrangement of reddish-brown angioid streaks with characteristic ragged outline. Radial extensions emerged from several places

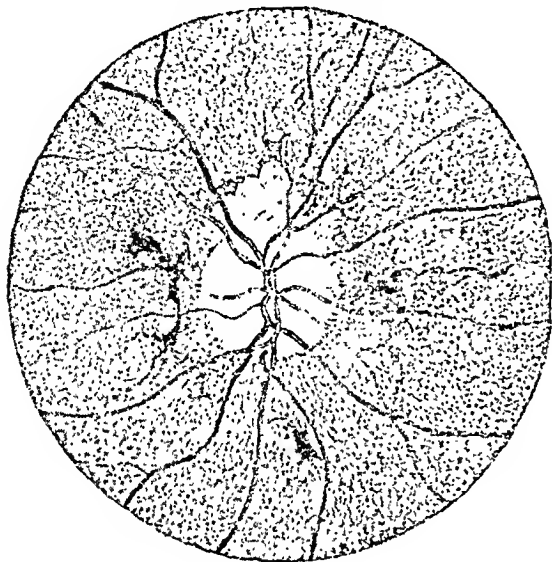


Fig. 1 (Klien). Right eye of Case 1. Very early stage of angioid streaks. There is an incipient, opaque, yellowish area above disc.

patients, however, are accompanied by illustrations depicting the disease in early, advanced, and late stages, to facilitate reference to some of the clinical details in the course of the histopathologic description.

CASE REPORTS

Case 1. B. A., a man, 56 years of age, entered the eye clinic of Rush Medical College with the complaint of presbyopia. The corrected vision in each eye was 1.2 and J1. The external ocular findings, optic discs, and retinal vessels were normal. Both discs were surrounded by a circle of reddish-brown angioid streaks from which numerous radial extensions originated. There was no visible macular lesion in either eye, but the posterior polar

* This patient was presented by Dr. Nomland and Dr. Klein at the Chicago Dermatologic Society, October 19, 1932.

and could be followed far into the periphery. Near the temporal margin of the disc there was a grayish, poorly defined choroidal lesion, 3 by 4 disc diameters in size, with irregular pigment inclusions and some superimposed connective tissue.

In the left fundus (fig. 2), there were similar but more advanced pathologic findings. The macula was occupied by a gray, ill-defined plaque, 1 by 1 disc diameters in size, into which a large reddish-brown streak seemed to merge. It was almost surrounded by a zone of fine yellowish dots of moth-eaten appearance. Between disc and macula there was a spiderlike formation of streaks, and in its neighborhood, there were several small, deep, flat hemorrhages. Within this broad streak, choroidal vessels of normal appearance were distinctly visible. There were also several areas of pigment proliferation and of diffuse opaque yellowish discoloration. In several light-colored areas, choroidal vessels were distinctly visible, and one of them, above the disc, appeared sclerosed.

In the periphery of both fundi there were fine, diffuse, granular pigmentary disturbances, and, in general, the posterior polar regions between the streaks had a peculiar veil-like haze.

The patient was observed for two years, during which time hemorrhages recurred around the macular lesions. One retinal vessel, crossing a large streak, was, at first, observed to have a sheathing with a grayish-black pigment. This disappeared in the course of several months.

The patient had an essential hypertension with blood pressure around 158/88 mm. Hg. The blood-cholesterol level was normal. The diagnosis of bilateral angioid streaks with associated pseudoxanthoma elasticum was made, and the diagnosis of the skin lesion was confirmed by Dr. R. Nomland in the Department of Derma-

tology. Dr. Nomland said that a biopsy specimen of the skin stained with orcein and hematoxylin showed, in circumscribed areas in the subpapillary and middle cutis, elastic fibers occurring in coils, which were thickened, broken, and fragmented. These fibrils took an intensive blue stain with hematoxylin and

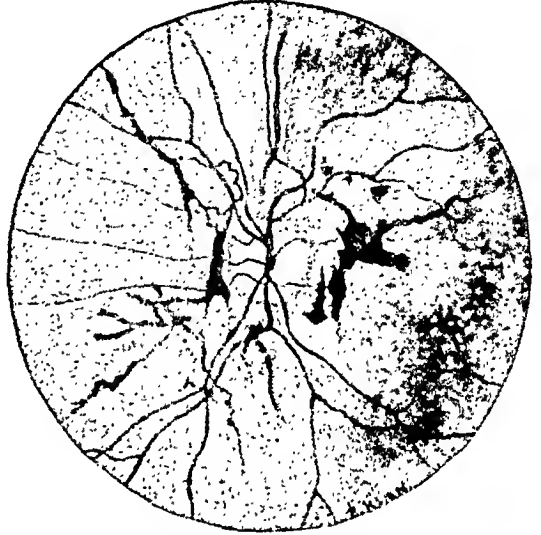


Fig. 2 (Klien). Left eye of Case 2. Advanced stage of angioid streaks. There are beginning macular lesions in the form of gray area surrounded by yellowish spots with moth-eaten outline. Sclerotic choroidal vessel visible above disc. Choroidal vessels visible within broad angioid streak.

turned dark brown under the influence of silver nitrate, suggesting the presence of calcium (Nomland and Klein⁸).

Several years later Finnerud and Nomland⁹ published further work on pseudoxanthoma elasticum, in which they demonstrated the presence of calcium in the form of the phosphate by staining methods, quantitative chemical analysis, and microchemical means. This is especially mentioned here because of the parallelism between skin and eye findings. Although the presence of calcium is only secondary to the primary elastic degeneration in skin and eye, it evidently plays a role in producing the great variety of findings

which characterize the later stages of the ocular disease.

*Case 3.** N. A., a man, 42 years of age, was sent by his dermatologist for ocular consultation. At the time of his first visit 15 years ago, he complained of failing left vision of several years' duration. He had an extensive pseudoxanthoma elasticum of the skin and attacks of purpura

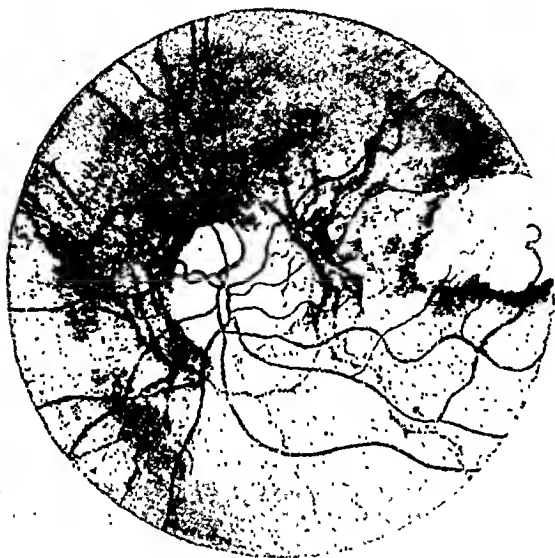


Fig. 3 (Klien). Left eye of Case 3. Late stage of angioid streaks. There is a disciform macular lesion, extensive opaque yellowish color with pigment flecks below disc.

hemorrhagica. The right vision was 1.2; the left, 4/200. The external ocular findings, discs, and retinal vessels were normal. There was extensive angioid-streak formation without a macular lesion in the right fundus. The left fundus is pictured in Figure 3. Within the broadest streak, between macula and disc, several choroidal vessels were visible. Many of the streaks had light-colored centers but lacked visible choroidal details. There was a disciform macular lesion. Adjoining the inferior margin of the disc, there was an opaque yellowish-white area, stud-

ded with numerous small brown dots, which extended far into the lower fundus periphery and on the temporal side followed the outline of a broad radial angioid streak.

A recent report from the patient states that the right eye also has now lost its central vision and that the pseudoxanthoma covers most of the body. The outbreaks of purpura have become less frequent, but two years ago an enlargement of the spleen and polycythemia vera were discovered.

Case 4.† J. S., a man, aged 49 years, entered the eye clinic of Rush Medical College complaining of bilateral progressive loss of vision for the past two years. For the past seven years he had noted a slowly advancing enlargement of the head with subsequent impairment of hearing and a diminution of his height. A diagnosis of osteitis deformans was made and confirmed.

At the time of the first visit, corrected vision was: R.E., 0.4 and J1 at 6 inches; L.E., 0.1 and no Jaeger. There was very high bilateral mixed astigmatism. Aside from an extremely wide interpupillary distance, the external eye findings were normal. Both optic discs showed a marked *typus inversus*, but they and the retinal vessels appeared normal. Around both discs there were incomplete circles of angioid streaks, which varied in color from reddish-brown to yellow. There were a few radial extensions. In the left eye, there were scattered deep hemorrhages, which appeared to be in the same level as the streaks. The fundus picture in both eyes was, however, dominated by the macular lesions, which consisted of well-defined, slightly prominent masses with inclusion of brown pigment.

There was a large paracentral scotoma in the right field, a central scotoma in the

* Dr. O. H. Foerster, Milwaukee, who has had this patient under observation for the past 15 years, has supplied all but the ocular data.

† This patient was presented at the Chicago Ophthalmological Society, April 4, 1941.

left field, and a moderate, irregular, concentric contraction of the peripheral visual fields.

During four years of observation, there were repeated deep hemorrhages in and around the macular lesions and the vision deteriorated to 1/200 in the right eye; 2/200 in the left eye. There was a marked increase of phosphatase in the blood (24 Bodansky units as compared to a normal of 5 to 8), a finding which is of great differential-diagnostic importance, as it is already present in the subclinical forms of osteitis deformans.

In addition to the symptoms of osteitis deformans, the patient had marked generalized arteriosclerosis, especially tortuous and thickened temporal arteries. Enlarged veins and arteries had eroded the skull in places, and one large vein over the right frontal area was pulsating.

The association of angioid streaks and Paget's disease was first emphasized by Terry,¹⁰ who collected four cases from the literature and added five of his own. Two more cases have since been reported by Lambert,¹¹ and one by Morrison.¹² This association may be much more frequent than reports in the literature lead one to believe, because in many reports of Paget's disease, the patient's defective vision is stated without investigation of its cause. Two of the most interesting reports in this connection concern two patients with osteitis deformans and multiple calcium deposits in various, otherwise normal, soft tissues and inner organs (Wells and Holley,¹³ Seligman and Nathanson¹⁴). Calcifications of healthy tissues are difficult to explain, and it is usually assumed that circulatory disturbances favor it. According to some authors, the increased amount of phosphatase may have a close causal relation to the deposition of calcium. There is rarely a hypercalcemia in Paget's disease, although the calcium-phosphorus balance is said to be

disturbed. As some one expressed it: "The bone lesions surrender calcium to the tissues." It is interesting that the deposition of calcium, whenever present, was found in otherwise healthy tissues. It could, therefore, also be deposited in an otherwise healthy Bruch's membrane leading to fragility and angioid streaks, without preceding degeneration of elastic tissues. So far no association of Paget's disease with pseudoxanthoma elasticum, which would point to a selective degeneration of the elastic tissue, has been reported. Angioid streaks and Paget's disease have in common, however, frequent association with marked generalized arteriosclerosis, and circulatory disturbances on this basis may predispose to calcification of various tissues. Each patient with angioid streaks, especially those without associated pseudoxanthoma elasticum, should be tested for the subclinical forms of osteitis deformans by determining the phosphatase level in the blood, and each patient with Paget's disease should be submitted to a periodic fundus examination.

Case 5. E. G., a woman, aged 62 years, entered the eye clinic of Rush Medical College with the complaint of presbyopia. The vision in the left eye had been poor all her life.

Corrected vision was: R.E., 0.8 + 3 and J1; L.E., hand movements and correct light projection. External ocular findings in the right eye were normal. The cornea of the left eye was smaller than normal with numerous medullated nerve fibers. There were congenital nuclear and anterior-polar cataracts and between the 11- and 12-o'clock positions, vitreous herniated slightly through a congenital coloboma of the lens. The fundus was not visible.

The right optic disc was normal. There were several circular angioid streaks around it with three radial extensions, the

longest of which merged peripherally with a dull-red area, which was surrounded by a grayish discoloration. The macula was normal.

There was no pseudoxanthoma elasticum of the skin. This case is included because of the associated malformations of the other eye. Malformations in association with angioid streaks are mentioned by Boeck, who found vascular malformations in the form of opticociliary arteries in 3 of 14 cases with angioid streaks. Malformations were also found in our Case 4.

Case 6. St. J., a man, 53 years of age, was admitted to the neurologic service of Passavant Hospital in a serious condition, with the history of attacks of dizziness and speech difficulty of six months' duration. At this time his eye grounds were examined by Dr. Derrick Vail, who found angioid streaks in both eyes, a well-developed disciform lesion in the left macula, and a similar incipient lesion of the right macula. No fundus paintings or photographs were made because the patient was moribund.

Two reports of previous ocular examinations were obtained, one from (Dr. Gradle's office) 12 years ago, which mentioned an active, elevated lesion in the left macula with fresh hemorrhages, and a lesion resembling a healed choroidal rupture in the right fundus. Vision at that time was: R.E., 1.5; L.E., 10/200. Years later the patient was examined in the Mayo Clinic, where the diagnosis of bilateral angioid streaks was made.

The salient features of the general autopsy report were: arachnoiditis with cerebral hemorrhages, severe arteriosclerosis with ulceration and calcification in the aorta, and mild nephrosclerosis. There was no pseudoxanthoma elasticum of the skin.

Immediately after death, injections of a 10-percent solution of formaldehyde

were made into the orbital tissues around the eyeballs and, after enucleation, both globes were placed in a 10-percent neutral solution of formaldehyde for fixation. The external measurements of both eyeballs were equal and normal. Prior to the embedding, the right globe was cut into an anterior and posterior half, considering the possibility of photographic registration of any visible details of the eye ground. The retina, however, although in situ, was completely opaque and drawn into numerous minute radial folds around optic disc and fovea, making choroidal details invisible. The left eye was opened by a superior and inferior section. All intraocular structures were in situ. In the macula there was a slightly elevated whitish lesion, measuring 1 disc diameter, in the vertical, and $1\frac{1}{2}$ disc diameters in the horizontal diameter (fig. 4). It was surrounded by a pigmented zone which was densest and broadest above and nasally, where it measured 1 disc diameter. In various portions of the fundus, there were lighter, yellowish areas, especially above the disc and the disciform macular lesion; other portions, particularly within 3 to 4 disc diameters around the disc and below the macular lesion, gave the impression of a grayish veil. Adjacent to the disc, there were fine radial folds of the retina which obscured the deeper-lying details in this area. There were two distinctly visible angioid streaks; one, broad and short, radiated from the peripapillary area into the inferior temporal sector. The broad portion had a yellowish color and dark, ragged outlines, and in only one place, along the upper outline, there was a light accompanying line. At a distance of about 2 disc diameters from the optic papilla, the streak faded out as a narrow grayish-brown line. The other visible streak radiated from the peripapillary area of the superior temporal sector and could be fol-

lowed far out into the periphery as a ragged yellowish band, with brown borders in several places. A short branch from this upper streak joined the disciform macular lesion. The superior calotte, which was removed from this globe, contained the end of this angioid streak, and was embedded in paraffin, while the main portions of both eyes were embedded in celloidin.

Histologic findings. Both eyes were sectioned from above downward. Of the right eye only the posterior half has, as yet, been sectioned. The anterior segment of the left eye was normal. There were no calcium deposits in the corneal or conjunctival epithelium. The pathologic findings in the posterior segments of both eyes were similar, only further advanced in the left eye, and they shall be discussed together as far as possible.

Since the pathology of angioid streaks centers around the lamina basalis of the choroid, a few general remarks about this structure are in place. The inner lamella of this membrane is of a homogeneous cuticular type and is considered as the basal membrane of the pigment epithelium. The outer portion consists of a plexus of fine elastic fibers which are connected with the abundant elastic fibers of the capillary interstices in the choroid. In the posterior segment these two portions are joined together by an invisible cement substance. In most sections the cuticular layer is more difficult to see than the elastic lamella.

In the sections of both eyes, stained with hematoxylin-eosin, attention was focused immediately upon the deep-blue stain of the lamina basalis, which stood out as a broad, easily visible line throughout the posterior polar region. Toward the equator this deep stain ceased to be homogeneous but became spotty and in the periphery the membrane had an inconspicuous normal appearance.

There were numerous breaks in the membrane, which increased in number toward the posterior polar regions. Some of these were quite small and affected only the outer elastic portion of the membrane, while the choriocapillaris under

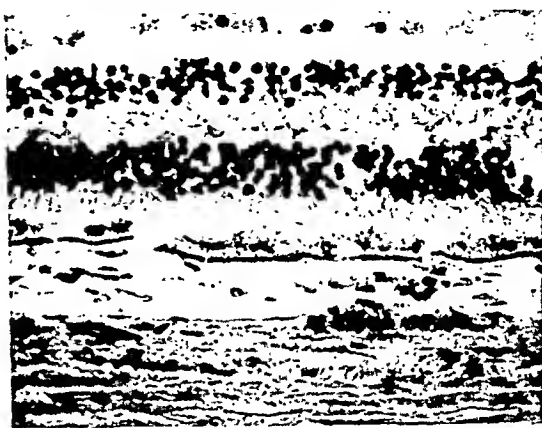


Fig. 6 (Klien). Paraffin section, hematoxylin-eosin, $\times 450$. Multiple fractures, mostly artefacts, of Bruch's membrane, showing its extreme fragility.

them, the inner cuticular portion, pigment epithelium, and retina were completely intact. The edges of the breaks were often abrupt with slightly frayed ends (fig. 5); others were oblique with slanting margins (fig. 8). Visible connections of some of these edges and of entire short fragments with the elastic network of the choriocapillaris had in many instances caused their displacement backward. In one area an artefact had resulted in some tangential sections of Bruch's membrane in a portion, containing narrow ruptures, which had the almost identical shape of the clinically visible streaks (fig. 9).

In addition to these narrow ruptures there were wide gaps in the lamina basalis over still well-preserved choriocapillaris (fig. 5), within which choroidal blood vessels would be visible clinically if the pigment epithelium did not carry much pigment. The deep hematoxylin stain of the membrane suggested the presence of calcium deposits, which were definitely



Fig. 7 (Klien). Spotty black stain of Bruch's membrane with Kossa test for calcium ($\times 400$). Thick cuticular layer under pigment epithelium.

demonstrated by a positive Kossa reaction (fig. 7). With this method, entire fragments, especially those dislocated into the deeper layers of the choroid, stained diffusely black, while in the portions of the membrane without gross lesions, the black stain indicating calcium was as spotty as the hematoxylin stain of corresponding areas in adjoining sections. In sections stained with orcein, the most peripheral portions of the lamina basalis took the elastic stain homogeneously, while a spotty distribution of it appeared farther back, and in the posterior polar regions long stretches of the membrane stained only faintly. By careful study of adjoining sections, it was possible to decide that the same portions of the membrane, which took a heavy hematoxylin stain and scarcely stained with orcein, indicated an almost complete degeneration

of the elastic fibers in these places. In other portions, which stained well with orcein, high magnifications revealed wavy, curly, and clumplike elastic fibers, particularly at the margins of some breaks. The fragility of the membrane, which must be intensified by the calcium deposits into the degenerated elastic portion, was well demonstrated by a very thin paraffin section (fig. 6) in which multiple, obviously artificial ruptures occurred.

Two factors may be responsible for the early calcification of the membrane. One is the affinity of degenerated elastic tissue for calcium salts, which is well known in general pathology; the other is the serous extravasation, due possibly to irritation of the choroidal capillaries, which was found in all of the histologic specimens of angioid streaks and which produces

bleblike detachments of the pigment epithelium from Bruch's membrane (fig. 8), and which may act similarly to serous fluid following circulatory disturbances in other tissues—a condition known to favor deposition of calcium.

Another special stain that gave a positive reaction in the lamina of both eyes was the Turnbull blue stain, one of the most reliable tests for the presence of iron. The lamina of the right eye stained faintly blue, that of the left eye intensely blue throughout the posterior polar region; while in a control eye with exten-



Fig. 8 (Klien). Oblique break in and beginning dislocation of small fragment of Bruch's membrane. Serous fluid under pigment epithelium. Choroid and retina normal.

sive posttraumatic retinal and subretinal hemorrhages, the lamina remained unstained. This, and the fact that the only retinal hemorrhage was found in the right eye with the less-advanced stage of the disease and the weaker iron stain in the lamina, suggests that not local hemorrhages but other metabolic disturbances are the cause for the deposition of iron salts in the lamina.

The structure which next to Bruch's membrane showed the most obvious

changes was the pigment epithelium. While it was normal over many of the small ruptures, it became irregular over the larger dehiscences, and small groups of its cells lost their pigment content,



Fig. 9 (Klien). Incidental tangential section of Bruch's membrane with cracks of similar shape as those clinically visible.

mostly without disruption of its continuity.

Through many breaks in the lamina basalis, capillaries and fibroblasts had grown between it and the pigment epithelium, mixing with new glial tissue and forming crestlike elevations which could be followed through many sections running alongside the ruptures of Bruch's membrane (fig. 10). A similar, newly formed tissue, arranged in mounds, occupied the left macular area, where it contained some amorphous hyalin and a plate of bone.

It was interesting to note that, under these hypertrophic lesions, Bruch's membrane was unusually well preserved and that the newly formed tissue preferred to grow upon the still-preserved membrane as a base rather than to fill the gaps over the ruptures (fig. 10). Most of the concentric lesions around the optic discs consisted of these hypertrophic streaks

rather than the simple ruptures. Although rarely missing, the pigment epithelium over these crests and mounds was usually degenerated into flat, nonpigmented cells. At the corners of some of these crests, granular calcium or amorphous hyalin granules were deposited. The latter and the collagenous portions of these hypertrophic lesions were brought out well by

calcified fragments of Bruch's membrane. Many of the choroidal and posterior ciliary arteries were normal; in others there were occasional defects or hypertrophic areas of the internal elastic lamella and spotty hypertrophy of media and adventitia. Here one could take issue with one of Hagedoorn's⁴ remarks about the choroid. He says (p. 947): "The



Fig. 10 (Klien). Hypertrophic lesions accompanying dehiscences of Bruch's membrane. Pigment hyperplasia and hyalin deposits at extreme left.

the Van Gieson stain. There were also extensive areas within which a homogeneous, deeply pink-staining layer of cuticular appearance and of slightly varying thickness was found between the lamina and the pigment epithelium. In the left eye they corresponded to the light, yellowish segments of the fundus sketched in Figure 4. Circumscribed excrescences of this cuticular substance covered here and there small ruptures of the lamina. Another type of faintly pink-staining, somewhat granular substance, underneath bleblike detachments of the pigment epithelium, was interpreted as slightly coagulated serous fluid.

The choroid appeared normal under the unbroken membrane and under small ruptures. Under more extensive dehiscences and especially under the hypertrophic lesions, the capillary layer was missing and in many places fibroblastic granulomas had formed around displaced

choroid is surprisingly inactive in closing the ruptures of Bruch's layer." A good reply would be: "Why expect it of the choroid?" There are no cells in the choroid which are vitally interested in an intact lamina basalis. The pigment epithelium is the structure whose health and continuity, so important for the visual function, is endangered by damage to the lamina, and, indeed, much of its above-described activity could be interpreted as reparative.

The retina appeared normal except over some of the hypertrophic lesions, where the first and second neurons were extensively damaged. There was one small subretinal hemorrhage, temporal to the macula of the right eye. Sclerosis of the retinal arteries was even less marked than that of the ciliary arteries. The optic nerves were normal excepting several hyalin bodies in the temporal half of the left nervehead.

SUMMARY

The anatomic study of two eyes with angioid streaks confirmed, on one hand, previous findings made by Boeck and Hagedoorn; on the other hand, it permitted the addition of several new observations, mainly because our specimens were unusually well preserved and because a detailed sketch of the posterior segment of one of the enucleated eyes facilitated a certain amount of direct correlation of the macroscopic and microscopic picture.

Previously recorded basic findings confirmed by our study are:

1. The diffuse degeneration of the elastic portion of Bruch's membrane, which leads to ruptures and dehiscences and may, as such, suffice to render the membrane opaque. A pertinent example of an ocular lesion in which a normally transparent tissue becomes opaque through degeneration of elastic fibers is the pinguecula.

2. The coexisting vascular disease, which in the eye affects mostly the posterior ciliary and choroidal vessels. It was found by both Boeck and Hagedoorn. However, Hagedoorn's statement, that the picture of the sclerotic arteries in eyes with angioid streaks differs from that in other eyes with simple choroidal sclerosis, can be accepted only with reservations. Hagedoorn's patient had an arterial hypertension of 200/140 mm. Hg at the age of 48 years, and the uniform thickening of the media and internal elastic lamella of the ciliary and choroidal arteries in his patient goes well with this clinical symptom. In both of our specimens the picture was that of the simple senile, involutionary type of sclerosis, characterized by spotty but often considerable hypertrophy of adventitia and media, and by a slightly rarefied, or normal, or occasionally thickened, in-

ternal elastic lamella. The clinical findings, in a number of patients with angioid streaks, of marked generalized arteriosclerosis or arteriosclerotic heart or cerebral disease without arterial hypertension, favor the conception of a premature senile sclerosis.

3. The positive iron stain of the lamina basalis in the posterior polar region was also obtained by Hagedoorn but not by Boeck, who used a less reliable staining method. In our case it was more pronounced in the eye with the more advanced stage of the disease, indicating that the iron salts are deposited later than the calcium salts.

Our own observations concern mainly the morphology of the early degeneration and ruptures of Bruch's membrane and the correlation between clinical and histologic lesions.

1. The earliest ruptures were limited to the elastic portions of the membrane, leaving its cuticular layer, the pigment epithelium, and the overlying retina completely intact.

2. The early defects in the membrane were of two kinds, namely, abrupt vertical severances of the appearance of true breaks (fig. 6) and oblique dehiscences (fig. 8), depending, perhaps, upon whether the break occurred in a portion which was already calcified or in one which had undergone, as yet, only a degeneration of the elastic tissue.

3. A definite proof of the calcification of the membrane was obtained through a positive Kossa stain. The calcification of the membrane in the earlier stages is as spotty (fig. 7) as the elastic degeneration shown by the orcein stain.

4. A dislocation of the edges of the breaks or of entire calcified fragments of the membrane into the deeper layers of the choroid was observed in many places, brought about by their intimate connection with the elastic fibers of the chorio-

capillaris. During this process of dislocation, the first irritative response from pigment epithelium and choriocapillaris seems to appear, which later on gives such variety to the picture. The frequent and often considerable separation of the pigment epithelium from Bruch's layer was caused in different places, by three different kinds of material: (1) A cuticular substance produced by the epithelium cells themselves; (2) a serous extravasation from the choriocapillaris; or (3) a mixture of glial and fibrous tissue with capillaries, derived from pigment epithelium and choroid, respectively.

The correlation of clinical and pathologic findings is based partly upon our present knowledge of similar or analogous conditions already correlated in this manner; partly upon the direct comparison of details in the gross drawing and the corresponding place in the histologic sections of Case 6. On this basis correlation with histologic findings of the following clinical details can be made:

1. The early streaks of reddish-brown color, some with visible choroidal details between their outlines. They appear histologically as simple ruptures or dehiscences in a degenerated lamina basalis. Depending upon the age of the rupture, choriocapillaris or larger choroidal vessels are clinically visible within them. Their color is a lighter or darker red, depending upon the pigment content of the still intact, if not normal, pigment epithelium and that of the choroidal stroma. The adjacent fundus is not discolored, but merely not transparent (fig. 1 and fig. 5).

2. Reddish- or grayish-brown streaks with light accompanying lines as shown in the drawing (fig. 4). In the corresponding place in the histologic sections, and in numerous other places, there were ruptures in Bruch's membrane which were accompanied by linear crests of newly formed tissue between pigment

epithelium and lamina basalis. The hyalin deposits at the margins of some of these crests would intensify the light appearance of these hypertrophic streaks clinically.

3. Yellowish streaks (fig. 4) with or without dark or light accompanying lines. Through many adjacent sections narrow but thick, avascular, cuticular formations could be followed over narrow ruptures of the lamina, which clinically had the yellow color of drusen. The pigment epithelium was rarely missing over them, but had lost most of its pigment content and often consisted of only one layer of flat degenerated cells.

The most interesting correlations could be made regarding the appearance of the fundus in general. The two extremes in this respect were the diffuse, opaque, gray and diffuse, opaque, yellowish areas.

The gray areas corresponded to the layers of homogeneous, deeply pink-staining substance between intact pigment epithelium and lamina, which appeared to be due to an overproduction of cuticular substance similar to the basal membrane of the pigment epithelium and the well-known drusen. In the lamina covered by this substance, there usually were many ruptures, and one was reminded of nature's attempts to maintain continuity as, for instance, in the cornea, where endothelial cells become overactive over tears of Descemet's membrane, producing thick layers of a Descemet-like substance and endothelogenous connective tissue. The epithelium over these areas was deeply pigmented and together with the two opaque layers under it—the degenerated elastic lamella and the thick cuticular layer—it appeared clinically as an opaque gray haze (figs. 2, 4, and 7).

The diffuse, opaque, yellowish areas corresponded to similar, perhaps slightly thicker, diffuse cuticular deposits, over

which the epithelium had lost its pigment content, so that the color of the underlying plaques became more evident (fig. 3). The yellow lesions appeared to be the oldest and resulted from the slowly progressive degeneration of the pigment epithelium over the extensive cuticular plaques.

The degeneration of the pigment epithelium is at first limited to isolated groups of its cells and this fact, demonstrable in the sections, may well be responsible for the light-colored dots, which appear within the gray areas and which have the color of drusen, but very unlike drusen, have a moth-eaten outline (figs. 2 and 8). In an advanced stage of this degeneration, a few remaining pigment-bearing cells would be visible as dark spots on a yellowish background (fig. 3).

CONCLUSIONS

The pathogenesis of angioid streaks is based upon an abnormal fragility and opacification of the lamina basalis of the choroid. The natural variations of the intraocular pressure by muscular action or slight pressure upon the eyeball may, in such eyes, cause breaks in the membrane, the margins of which are clinically visible because the membrane has lost its translucency.

In all anatomic studies so far, the basis for this fragility and opacification of Bruch's membrane has been revealed to be primarily a degeneration of its elastic portion, corresponding to a general inferiority of the elastic tissue of the body,

as the frequent association with pseudoxanthoma elasticum of the skin and with severe, degenerative vascular disease indicates. Theoretically, however, deposits in the membrane of any kind, such as calcium, iron, or magnesium salts following a disturbance of tissue metabolism with or without coexisting constitutional disease, could also deprive the membrane of its transparency and elasticity. In angioid streaks associated with osteitis deformans, for instance, the sequence of events may be slightly different from that in the eyes studied histologically up to the present time. Deposition of calcium salts into a normal lamina basalis, similar to calcification of other healthy tissues in patients with Paget's disease, could also render the membrane fragile and opaque without preceding elastic degeneration. These considerations lead one to speculate about the possible varieties and types of pathologic processes which may affect the lamina basalis in the course of local or constitutional disease.

The clinical picture of angioid streaks represents not only the visible ruptures in Bruch's membrane, but also the multi-form end results of irritation of pigment epithelium and choriocapillaris by the sharp, calcified edges and fragments of the broken membrane. Calcification, therefore, even if secondary to the elastic degeneration in the pathologic process, is essential in production of all except, perhaps, the earliest manifestations of the disease.

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SURGICAL TECHNIQUE OF CORNEAL TRANSPLANTATION IN RABBITS*

A DISCUSSION OF THE PROBLEMS ENCOUNTERED AND SUGGESTIONS FOR THEIR SOLUTION

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The difficulty with which corneal transplantation is successfully accomplished is such that it is seldom attempted on human subjects until the surgeon has acquired some skill with the procedure on experimental animals. The laboratory animal best adapted to this operation, from the point of view of both expense and availability, is the rabbit. All of the pioneers in this new field of ophthalmic surgery (Castroviejo, 1931, etc.; Filatov, 1935, etc.; Thomas, 1930, etc.) have experimented at length on rabbits before proceeding to human patients. These men have written about the different types of operation practised by them individually on human beings, but no one has given a detailed account of the surgical technique employed in keratoplasty on the rabbit. The purpose of this paper is, therefore, to describe in detail the procedure of keratoplasty on rabbits, and the difficul-

ties encountered in this operation, following in general the technique employed by Castroviejo.

TECHNIQUE OF TRANSPLANTATION PROBLEMS ENCOUNTERED

There are problems in transplantation of the rabbit's cornea that are not encountered in the same operation on the human cornea. The rabbit's cornea is thinner than that of man, and this fact makes the placing of the suture, the apposition of the cut surfaces, and the prevention of postoperative bulging more difficult. Anesthesia is a trying procedure and some animals may die on the operating table. It is not feasible to bandage the rabbit's eye, and one must resort to lid sutures—an unsatisfactory method, to say the least, when a pressure bandage is desired. Infection is difficult to prevent in any laboratory animal, and the rabbit is no exception. The postoperative bed-rest and immobility, which are prescribed

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for the human patient after keratoplasty, are quite obviously out of the question for the rabbit. Once the surgeon is able to overcome these operative difficulties peculiar to the rabbit and is able to perfect his surgical procedure on this animal, he is better prepared to operate upon the human being.

This paper will discuss the operation of square, partial penetrating keratoplasty, and will give an account of the equipment needed, the preparation of the rabbit, the surgical procedure, as well as the management of the difficulties encountered.

EQUIPMENT REQUIRED FOR THE OPERATION

A narrow operating table, not over 12 inches in width and about 4 feet long, will be found very practicable for rabbit surgery. The height can be varied according to the standing or sitting position of the operator. The narrow table is desirable in order that both operator and assistant may be able easily and comfortably to reach the operative field. Any one of the common small instrument tables is satisfactory for the instruments. A good operating lamp of the hammer type provides satisfactory illumination. Other needed items—scrub sink, sterilizer, and so forth—will be found in any well-equipped animal operating room.

The following instruments (fig. 1) are necessary: (1) Castroviejo double-bladed knife, for marking the limits of the window in the recipient's eye and the limits of the graft in the donor eye. (2) Castroviejo's special keratome, 4-mm. wide, for making the initial incision into the anterior chamber in both the recipient and the donor eyes. (3) Modified de Wecker scissors, for cutting the remainder of the incision in both eyes. (4) Spatula, for lifting the graft from the donor eye and placing it in the recipient eye, and also

for last-minute manipulations of the graft when tightening and tying the suture. (5) Fine needle holder, for placing the sutures and tying. (6) Elschmig's fixation forceps, for grasping the episclera and fixing the eye. (7) Fixation forceps, for holding the lids when they are sutured together. (8) Scissors, for cutting the sutures. (9) Mosquito clamp, for holding the moss suture in the center of the window being cut out of the recipient's cornea. (10) Small, straight, toothless forceps for tightening suture. (11) Small, curved, toothless forceps, for tightening the suture. (Often times either the straight or curved forceps will also be used for tying the suture.) (12) Speculum, for separation of the lids. (13) 7-0 double-armed black silk suture with atraumatic needles.

The following solutions and ointments are recommended: (1) 3-percent atropine-sulfate solution. (2) Sodium-pentobarbital solution (45 mgm. per cc. of 10-percent alcohol solution). (3) 4-percent cocaine solution. (4) 20-percent argyrol solution. (5) Sterile physiologic saline solution. (6) 2-percent fluorescein solution. (7) 1-percent sodium citrate solution. (8) Adrenalin solution (1:1,000). (9) Penicillin ophthalmic ointment. (10) 1-percent atropine-sulfate ointment.

PREPARATION OF THE RABBIT

In selecting rabbits for keratoplasty, it is well to obtain an animal weighing five pounds or more. Smaller rabbits may be used, but the operation becomes more difficult on the smaller eye. The rabbits should be obtained sufficiently far in advance of the operation so that they may occupy their new quarters for at least 10 days prior to surgery. A small percentage of rabbits will die when removed to the small cages that constitute their quarters in the medical school or hospital. Further, it has been found that new rabbits do not

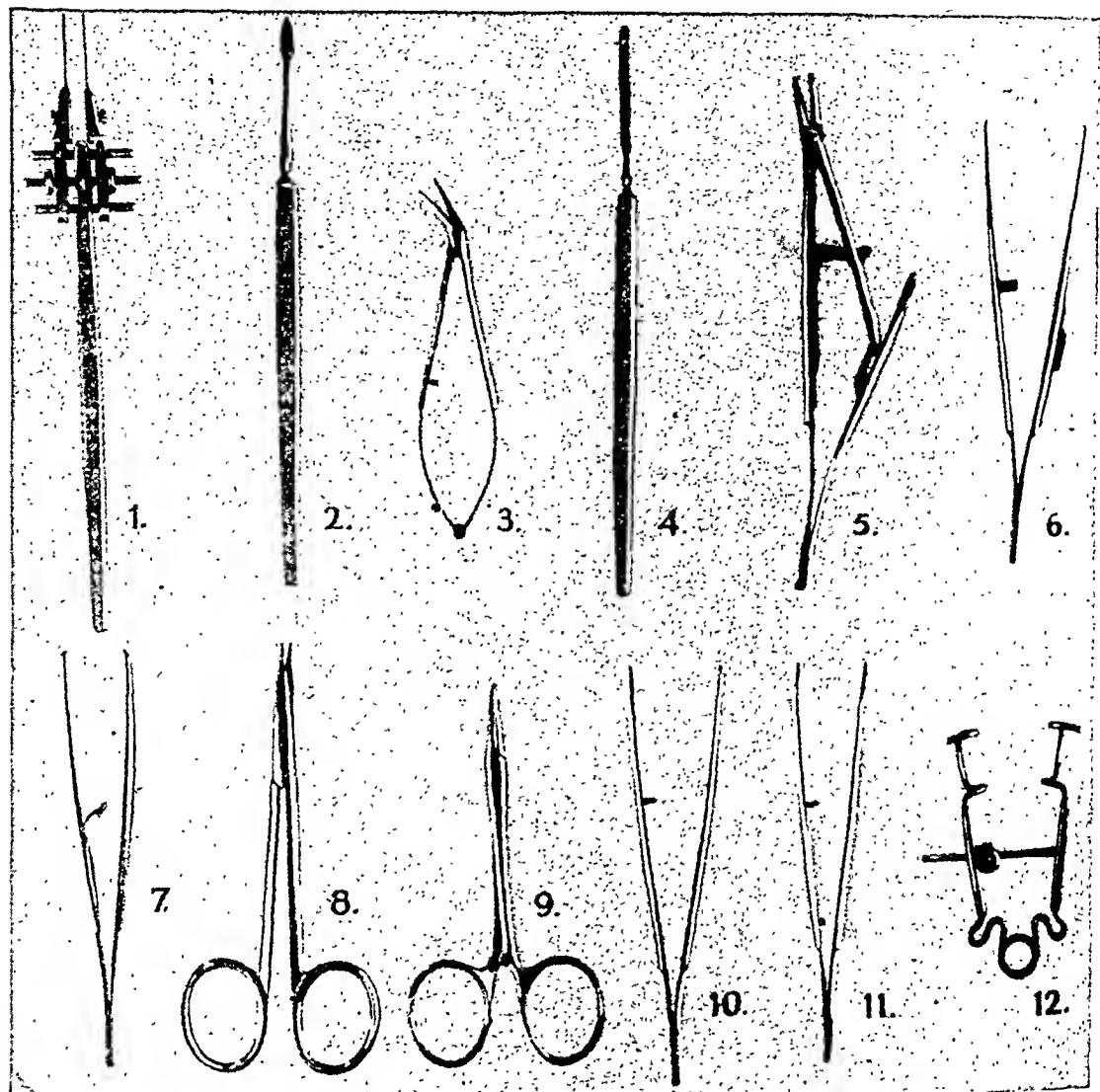


Fig. 1. (Stansbury and Wadsworth). Recommended instruments: (1) Castroviejo double-bladed corneal knife; (2) Castroviejo special keratome; (3) modified de Wecker scissors; (4) spatula; (5) needle holder; (6) Elschnig's fixation forceps; (7) fixation forceps; (8) scissors; (9) mosquito clamp; (10) small straight toothless forceps; (11) small, curved, toothless forceps; (12) speculum.

do well postoperatively. On the other hand, rabbits that are well acclimated to their lot will usually take the anesthesia and operation uneventfully.

Six hours prior to the operation, the rabbit is brought to the animal operating rooms, and atropinization of the designated eye is started. A drop of 3-percent atropine-sulfate solution is instilled into this eye each hour for six doses.

Sodium pentobarbital, intravenously, is used for the anesthesia. A solution is made of 45 mgm. of sodium pentobarbi-

tal per cc. of 10-percent alcohol solution, and 1 cc. of the resulting solution is given for each kilogram of body weight. Three fourths of the estimated dosage is slowly injected intravenously $1\frac{1}{2}$ hours before operation, and the remainder of the calculated amount is given one-half hour before operation. This will usually be sufficient, but sometimes it is necessary to introduce a very small additional amount just before fastening the animal into the clamp.

After the second injection of sodium

pentobarbital, the rabbit will lie quiet and submit to the trimming of the hair around the operative field. The hair is removed from an area at least one centimeter wide around the eye. In addition, all the long whiskers on that side of his head are cut. At this time, a drop of 4-percent cocaine solution is instilled into the conjunctival sac.

The rabbit is then placed on the operating table and fastened into the special clamp (fig. 2). The head is adjusted to fit snugly into the clamp, and the screw is turned down. The animal is further immobilized by lashing the extremities to the table (fig. 3). Twenty-percent argyrol solution is then instilled into the conjunctival sac, washed out with sterile saline, and another drop of 4-percent cocaine solution is instilled. A small sterile sheet, with a diamond-shaped opening for the

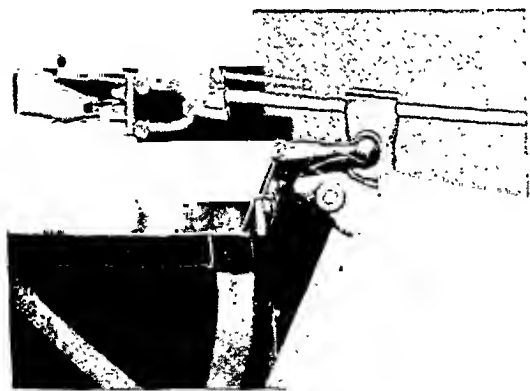


Fig. 2 (Stansbury and Wadsworth). Clamp for immobilization of the rabbit.

eye, is then placed over the rabbit and fastened with two towel clamps.

SURGICAL PROCEDURE

Separation of the lids is obtained by means of the standard eye speculum. Care must be taken when inserting the speculum to be sure the nictitating membrane of the rabbit is caught behind one arm of the speculum. The eyeball is then fixated with Elschmig's forceps, and the area to be removed is marked out with the double-

bladed Castroviejo knife. The blades of this knife have previously been treated with 2-percent fluorescein solution, so that the knife cuts and stains the cornea



Fig. 3 (Stansbury and Wadsworth). Immobilization clamp with the rabbit in position.

at the same time. Using a 7-0 double-armed silk corneal suture with atraumatic needles, the continuous corneal suture of Castroviejo is then inserted, placing all the bites 1 mm. from the fluorescein-stained incision (fig. 4).

It is our practice to begin the first bite at the 9-o'clock position and to come out at the lower left-hand corner of the square; to begin the second bite at the upper right-hand corner of the square and to come out at the 12-o'clock position; to begin the third bite at the 6-o'clock position and to come out at the lower right-hand corner; to begin the fourth bite at the upper left-hand corner and to come out at the 9-o'clock position. The last bite begins at about the 3-o'clock position and comes out about 3 mm. from the limbus. As each bite is placed, the loop of suture so formed is placed beyond the upper left corner of the square. Each succeeding loop is placed on top of the preceding one. One end of the suture is then cut off, and a bite is placed in the middle of the square. The two ends of this last suture are then fastened in a mosquito clamp.

A keratome incision is then made in the lower right-hand corner of the square, beveling it in the manner described by Castroviejo and Thomas. Care must be exercised in this maneuver to avoid injuring the lens. By making this incision in the corner of the square, only one cut is left on that leg of the square to be done with scissors. As soon as the anterior

ner. Finally, the upper end is finished in the same manner. While the assistant continuously drops citrate solution over the operative field, a similar graft is excised from the donor eye, using the same procedure, except that no Moss suture is used, and the instruments are not tilted when cutting.

The graft is then picked up with the

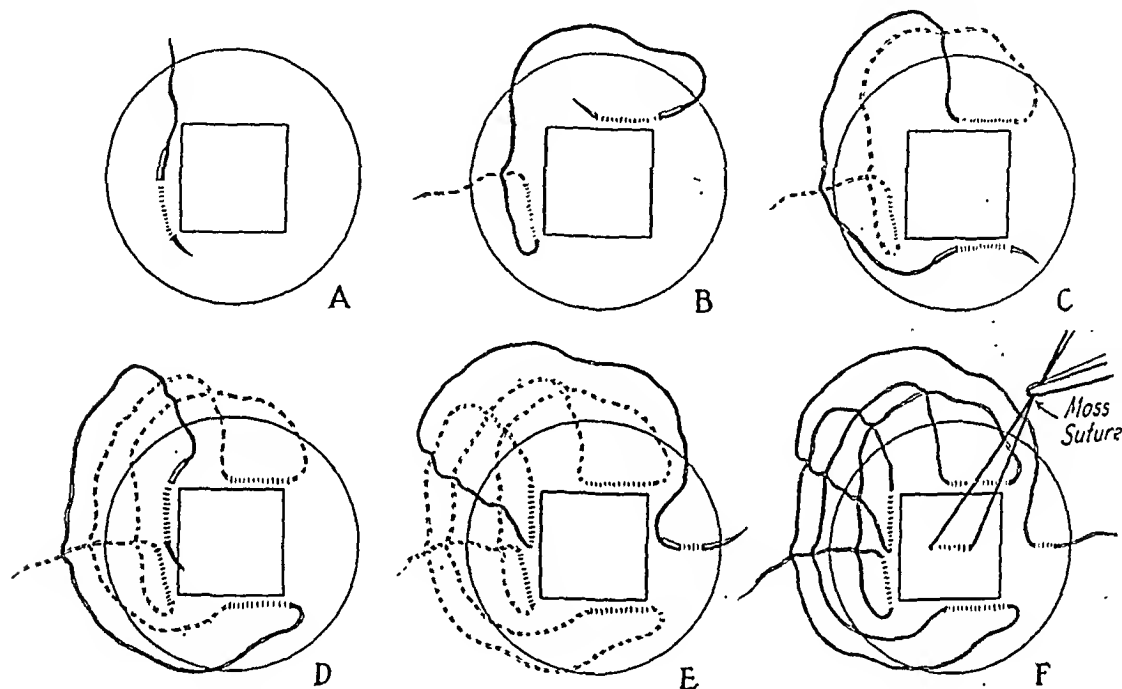


Fig. 4 (Stansbury and Wadsworth). Steps in placing the suture in the cornea, with arrangement of the loops.

chamber is opened, the assistant begins instilling 1-percent sodium-citrate solution into the conjunctival sac (to avoid formation of fibrin). While the square is lifted a slight distance above the lens with the mosquito clamp attached to the Moss suture, the lower blade of the de Wecker scissors, tilted in the same manner as was the keratome, is then passed through the keratome incision and the remainder of the lower leg of the square is completed. The scissors are turned and the left hand side of the square is cut. The scissors are then brought down to the lower right-hand corner of the window, and the right-hand side is completed in the same man-

spatula and gently placed in the window in the recipient's cornea. Any rolling of the edges or corners is corrected with the spatula. Then the suture is tightened, using the small straight and the small curved utility forceps. We begin to tighten with the last suture inserted and work backwards to the first one (fig. 5). When all the sutures are snug, and the graft is in good position, a surgeon's knot is tied at the 3-o'clock position, near the limbus. The instillation of the citrate solution is then stopped, and a drop of 3-percent atropine solution is instilled. At this point, we inject a small amount of adrenalin solution (1:1,000) subconjunc-

tively. Three through-and-through lid sutures are then put in position—one in the center of the lids, and one 3 to 4 mm. to each side. Before the last suture is tied, penicillin ophthalmic ointment is injected into the conjunctival sac.

When the rabbit is taken back to his quarters, a meshed-wire floor is placed in his cage instead of straw. Every other day, postoperatively, 1-percent atropine

DISCUSSION

ANESTHESIA

Probably no one factor has given us more concern than the administration of the anesthesia. The first system tried was to calculate the amount of pentobarbital to be given and to make a slow intravenous injection of this amount. Many rabbits will go into respiratory failure

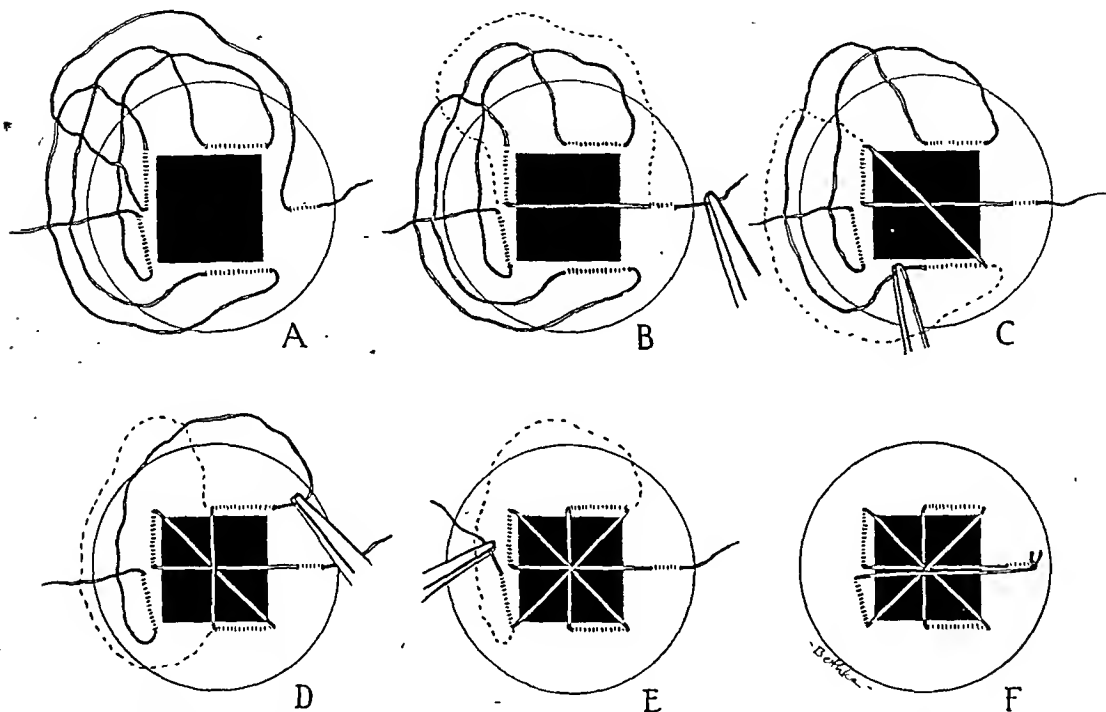


Fig. 5 (Stansbury and Wadsworth). Final steps in completion of the suture.

ointment and penicillin ophthalmic ointment are instilled into the conjunctival sac. One week after operation, the animal is again given the sodium-pentobarbital anesthesia, and the sutures are removed. If anterior synechiae are present, they are broken up with adrenalin subconjunctivally, or neosynephrin or atropine in the conjunctival sac. If infection is present, penicillin is used as long as necessary. It is desirable to keep the rabbit 6 to 8 months postoperatively to determine whether or not the graft will remain transparent.

within 15 minutes if this is done. Once administered, there is practically nothing the operator can do to lighten the effects of the anesthetic. Nonvolatility is one of the characteristics of the barbiturates that makes for a prolonged and continuous anesthesia. This same nonvolatility precludes their excretion through the lungs, and so the concentration depends solely on the dosage. Once too much is given, we have been unable to resuscitate the rabbit. Since this was the case, we tried to weigh the rabbit more carefully and to calculate the dosage more accurately. The

response to pentobarbital is quite variable in different rabbits, however, as it is in human beings. Large rabbits may die with less than the calculated dosage, and small ones may require double the estimated amount.

The attempt was made to give the anesthetic intraperitoneally, but here the absorption was very slow and irregular. Large amounts are required for deep anesthesia, and the large number of doses and the amount of time required to watch the animals precluded this method. A weaker solution of sodium pentobarbital was tried, but this was not found to be satisfactory.

Finally, fractionalization of the anesthesia was worked out, and this system has proved satisfactory. Three fourths of the estimated dosage is slowly given in an ear vein $1\frac{1}{2}$ hours before operation. One hour later, if the rabbit is not too sluggish, the rest of the dose is given. Just before fastening the animal in the clamp, additional pentobarbital is given as needed. This method of fractionalization of the administration of the anesthesia has resulted in no deaths.

SEPARATION OF THE LIDS

Wide separation of the eyelids, without the interference of cumbersome instruments, is necessary during the operation: (1) to provide an operative field, and (2) to prevent pressure on the globe. In the rabbit we have tried three methods of holding the lids apart: (1) the conventional speculum, (2) sutures through the lids, and (3) Castroviejo mosquito lid-clamps.

Advantages of the speculum are ease and quickness of insertion and elimination of trauma to the lids. Some workers (Castroviejo, 1941,) believe that it interferes to some slight degree with instrumentation in the operative area, especially during use of the double-bladed knife,

and that it does not provide as large an exposure as the other two methods.

Lid sutures provide a satisfactory operative field and are particularly efficacious in immobilizing the nictitating membrane. However, their disadvantages are considerable. They are painful and often arouse the rabbit. They may cause hematomas of the lids. They often result in bleeding, and blood in the conjunctival sac, postoperatively, is undesirable because it forms an excellent medium for bacterial growth.

Castroviejo's lid clamps also provide a good field and do not have the disadvantages of the lid sutures. Nevertheless, the small drape used in rabbit surgery does not constitute a good anchor. Lid sutures and lid clamp may produce too much traction and may cause tenting of the lids, which will result in poor exposure.

After trying the second and third methods on a number of rabbits, the first method—the use of the lid speculum—was adopted as the least traumatic and the most facile procedure. It is comparatively easy to avoid touching the speculum with any of the cutting instruments simply by rotating the globe with the fixation forceps until the cornea is in the desired position. Katzin (1946) advocated complete immobilization of the globe by radial sutures in the limbus. This type of immobilization, in our opinion, is unsatisfactory, not only because its use may endanger the eye but also because it may compel the surgeon to work from awkward angles.

MARKING THE CORNEA

Correct marking of the cornea can be a great help in facilitating a successful transplant. If it is incorrectly done, however, the remainder of the procedure may be hindered by numerous unnecessary difficulties. The blades of the Castroviejo knife must be parallel and set firmly at the desired width (5 mm. for rabbits).

If the blades are not parallel, the resulting wide, ragged line will make it difficult to maintain a perfect square when the window is removed with the scissors.

The knife must be gently placed on the cornea in such a manner as to exert equal pressure on both blades; otherwise uneven lines will be made. Pressure should be sufficient to penetrate the epithelium only. If the marking is too deep, the lines tend to gape and the staining becomes diffuse. Care must be taken not to carry the lines too far along the cornea and cause unnecessary damage to the recipient epithelium. The second marking must be perpendicular to the first, or a square window will not result.

It has been our experience, as well as that of other workers (Carpenter and Smyth, 1946), that fluorescein on a rabbit's cornea will stain the entire cornea in a short time. However, we found that, by applying fluorescein to the knife and allowing it to dry before marking the cornea, the treated knife made very fine lines, which had less tendency to diffuse.

In marking the donor eye, it is advisable to hold the eye gently in order not to stretch the globe; otherwise, the transplant may be too small for the prepared area. In addition, if the eye is held too firmly, the lens will be pushed forward and its capsule will be ruptured while the transplant is being removed. Although this is not any great mishap, it adds to the difficulty of accurately cutting and removing the prepared square.

PLACING THE SUTURE

It is essential to the success of a keratoplasty that the suture holding the graft in place be located with exact precision. The suture in the corneal stroma should be approximately 1 mm. from the incision. If it is placed closer than 1 mm., it is difficult to cut the window without severing the suture. If it is placed farther

than 1 mm., it will tend to buckle the approximated edges of the cornea and the graft when the suture is tightened at the end of the operation. Furthermore, it is very important that the suture be placed so that the arms of the suture, as they crisscross over the graft, cross exactly over each corner, because these are favorite locations for bulging. That means that the suture must enter the cornea precisely opposite the apex of the right angle that forms each corner of the window. It was for this reason that Thomas gave up square transplants in favor of the circular form (Thomas, 1930).

The cornea puts up considerable resistance to the passage of the needle through its substantia propria. If the operator pulls away from the fixation forceps, the conjunctiva will not withstand the traction exerted in placing the suture but will give way at the limbus. However, if the fixation forceps are applied in such a manner that the force of the needle pushes toward the forceps, this accident will not occur.

What to do with the loops of suture while the operation is being finished is another one of the problems encountered. In order to avoid a snarl of the loops at the time when one wants to tie quickly and close the wound, it was found necessary to place the loops to one side in a definite pattern. We now lay all the loops of the suture to the upper left side, in the following manner. The first loop, which may be called the 7-to-1 loop, using the numbers as they appear on the face of the clock, is placed to the upper left, over the free end of the suture coming out at the 9-o'clock position. The second loop, called the 12-to-6 loop, is placed above the 7-to-1 loop. Likewise the third loop, the 5-to-11 loop, is placed above the 12-to-6 loop, and finally the 9-to-3 loop is placed above the other three. The free end extends off to the right (fig. 4).

Some operators place the entire suture, tighten the loops ready to tie, and then loosen the loops again, presumably to be sure the loops are located properly. This has been found unnecessary, provided the systematic steps outlined above are followed.

What should be done if a leg of the suture is cut during the operation? We have found that the corneal canals are very easy to relocate and that the needles will pass through the canals without friction; so the cut suture is pulled out and a new one inserted. If one goes too deep with the needle and perforates into the anterior chamber, the needle should be removed and a new canal made. This step is necessary to avoid formation of a fistula.

PROBLEM OF FIBRIN

The presence of fibrinogen in the normal aqueous of the rabbit results in the formation of fibrin as soon as the anterior chamber is opened, and may be a great bother in the completion of a keratoplasty. It has been our experience, as well as that of others (Thomas, 1934), that a solution of sodium citrate in normal saline will obviate the formation of fibrin.

Just as soon as the anterior chamber is opened, a continuous drip of 1-percent sodium citrate in saline should begin and be continued until the suture has been tightened and tied. If such a system is not maintained, troublesome collections of fibrin will accumulate within the window of the cornea and will render the placement of the graft more difficult. The loops of the suture must also be bathed in the citrate, or the firm snarling of the loops will endanger proper placement and lessen the chances for a satisfactory transplant. Not infrequently the coagulation may be so severe and firm that it is almost impossible to separate the sutures

from one another. The removal of the fibrin is so tedious and traumatic that the graft may be poorly placed. Soaking of the suture material in citrate before the sutures are placed in the cornea will help to maintain their pliability and softness.

TYING THE SUTURE

The mere matter of tightening the loops and tying the suture would appear very simple, but such is not always the case. If the loops are not kept in some pattern so that the operator can identify them, he will find a snarl of silk before him. However, if they are arranged as has been described, the tying can be expedited.

We use the two small forceps, one for lifting up the loop and the other for pulling it through the cornea. First we lift up the 9-to-3 loop and pull it through loosely (fig. 5), pulling on the free end of the suture near the limbus at the 3-o'clock position. Next the 5-to-11 loop is lifted up and pulled through at the 6-o'clock position. Then we lift up the 12-to-6 loop and pull it through at the 1-o'clock position. Finally, the 7-to-1 loop is lifted up and pulled through at the 9-o'clock position. The apposition of the graft is then checked all around the periphery, using the spatula for any necessary adjustments.

With the same two forceps, this procedure is now repeated and all the loops are given a final tightening. They are pulled as tight as can be done without dimpling or buckling the cornea at any place, either on the graft or on the recipient's own cornea. This is very important, because the suture controls the apposition of the cut surfaces and, if snug enough, prevents bulging. The suture is tied near the limbus, first with a surgeon's knot to hold the wet suture material and then with a conventional tie. Finally, the spatula may be inserted between the

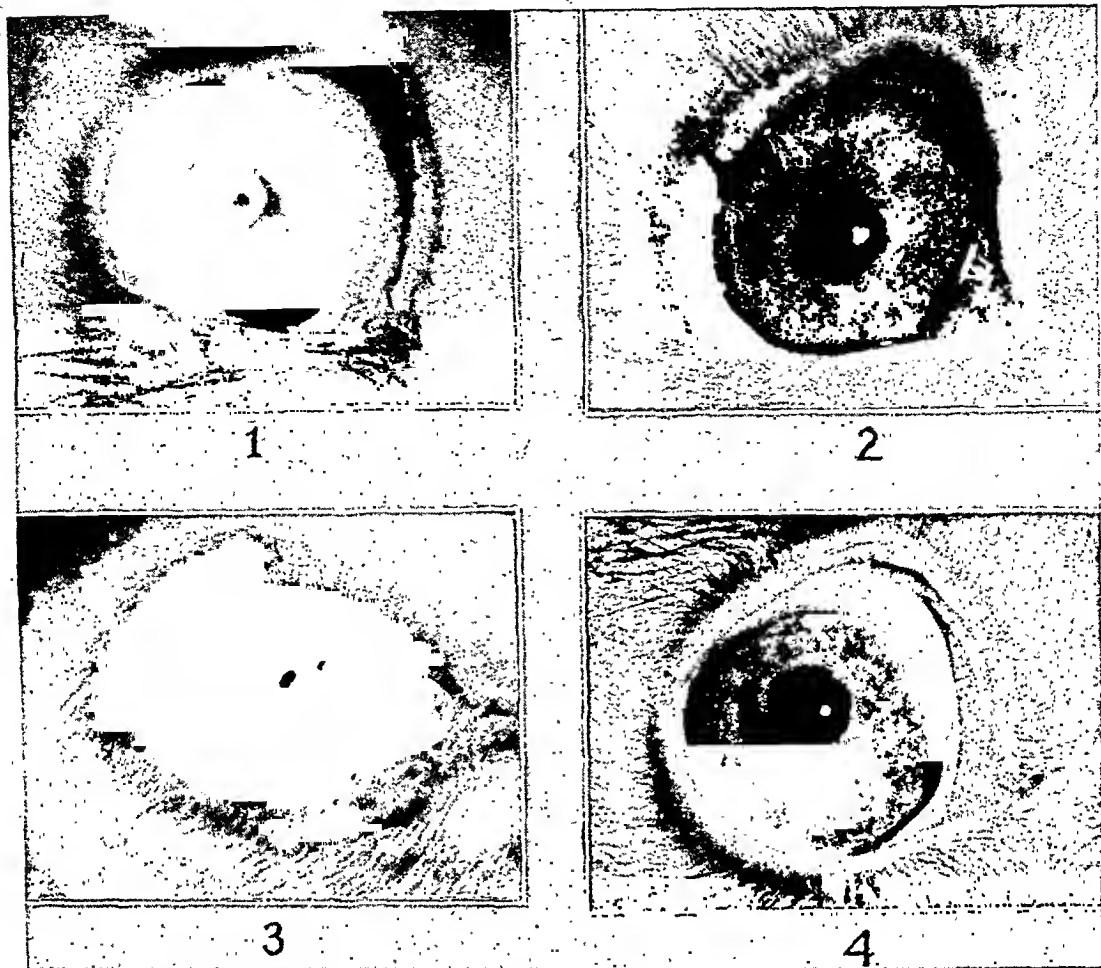


Fig. 6. (Stansbury and Wadsworth). Pictures of rabbits after transplantation. (1), (2), and (3) show successful results. (4) is a postoperative ectasia.

center of the graft and the crossing loops of the suture and gently lifted once or twice, to give a last general distribution of the tension of the suture.

LID CLOSURE

Simple through-and-through fine black silk sutures, placed at equal intervals through the lid margins, give a very satisfactory closure of the lids. Numerous other methods were tried in an endeavor to obtain pressure, but various disadvantages precluded their adoption. Two mattress sutures were tried, but they were more traumatic and several troublesome postoperative infections resulted. Moreover, they frequently pulled through,

probably the result of the rabbit's efforts to remove the uncomfortable sutures. In an effort to maintain pressure, a wide overlapping of the lids with mattress sutures was tried, but the resulting irritation and secondary infection made this method impracticable.

POSTOPERATIVE ECTASIA

One of the difficulties we have not been able to overcome is the postoperative bulging of the central portion of the cornea, including the graft. Often, when we remove the sutures on the 7th or 8th day, we find the graft in good position, the anterior chamber reformed, no synechiae and no infection, only to be followed a

day or two later by very considerable bulging of the whole center of the cornea, with the graft at the apex of the conus. Some of these cases have progressed satisfactorily to complete healing of the scar, and the graft has remained in place and transparent for over six months (fig. 6). We attribute this type of unsuccessful result to our inability to apply a pressure bandage to the rabbit's eye. These observations make fibrin fixation of the cornea without suture (Katzin, 1946) appear a most unlikely procedure. We have been unable to prevent this condition in some rabbits, although we now remove the lid

sutures one week after operation and the corneal suture about 10 days postoperatively. We have not employed this system long enough to determine its efficacy.

CONCLUSION

A satisfactory method of keratoplasty on rabbits, following in general the technique of Castroviejo, is described. A list of the necessary equipment and a detailed description of the procedure followed are recorded. The numerous difficulties encountered, and our methods of solving these difficulties are discussed.

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THE SUBSTITUTION OF CEREBROSPINAL FLUID FOR VITREOUS CLOUDED WITH OPACITIES*

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HISTORICAL REVIEW

"Among the most unsatisfactory cases as regards treatment and prognosis that seek advice at our various hospitals, those in which impaired vision or lost vision is due to opacities of the vitreous form a considerable number. Unless such can be traced to specific diseases, treatment is practically useless." This was said by Ford¹ 57 years ago, and the statements are as nearly true today as when they were written. Ford attempted with considerable success to clear vitreous opacities in human eyes by withdrawing 10 to 18 minims at intervals of from 2 to 3 days.

In the years intervening between 1890 and 1947, many investigators have repeated the work of Ford, although some of them had no knowledge of his work. The subject was well reviewed by zur Nedden,² in 1928 and N. L. Cutler,³ in 1937.

The first worker actually to attempt the substitution of a clear medium for vitreous clouded with opacities in human eyes was Gradenigo,⁴ who, in order to avoid loss of intraocular pressure, devised a double syringe of such construction that it delivered to a closed space containing fluid the same amount of fluid that it withdrew, thus leaving the fluid pressure unchanged. To this syringe were fixed two rubber tubes of fine caliber, leading to two sharp needles both of which were inserted into the vitreous chamber at the equator of the eye, one between the medial

and superior recti, and the other between the lateral and superior recti. In this manner, Gradenigo replaced cloudy vitreous with normal saline solution or vitreous from freshly killed animals without reduction of intraocular pressure. No clinical studies on diagnosis, amount of vitreous replaced, vision, or intraocular pressure were included in this paper.

In 1906, Deutschmann⁵ reported 67 human cases of retinal detachment treated by repeated injections of very small amounts of vitreous from calves' and rabbits' eyes. Even though the primary aim of this work was to reattach detached retinas, it is quoted as one of the earliest attempts in ophthalmology to inject foreign substances into the vitreous. Three of the cases were cured, 26 were improved, and 38 were unimproved. Deutschmann mentioned that vitreous abscess was a rare complication of this procedure.

Komoto,⁶ in 1910, reported two cases in which "good vision" was restored after the eyes had been blind for a long time following retinal hemorrhages into the vitreous. He made a scleral incision and irrigated the vitreous chamber with normal saline solution, presumably leaving a sufficient amount of saline to approximate normal intraocular volume.

Fifteen human cases of vitreous opacities caused by hemorrhages, iridocyclitis, hemophthalmos, suppurative infiltration of the vitreous, and opacities associated with detached retina treated by injection of normal saline solution were reported by Elschnig,⁷ in 1911. Vitreous (0.4 to 0.8 cc.) was withdrawn, and an equal amount of normal saline solution was substituted. All of the eyes had been blind for years. Best results were obtained in

* The expenses connected with this research were met by the Florence Ellsworth Wilson Memorial Fund Fellowship in Ophthalmology of The Eye-Bank for Sight Restoration, Inc., New York.

the cases of hemorrhage into the vitreous. Iritis and a small hypopyon complicated the recovery of one case. Poorest results were obtained in cases of opacities following iridocyclitis. Fair results were obtained in the other cases. Exact studies of vision and intraocular pressure were not made. One or two injections were made at intervals of 3 to 10 days.

In 1912, Dor⁸ reported two cases in which cloudy vitreous due to hemorrhage were treated by Elschmig's technique of withdrawing less than 1 cc. of vitreous and substituting an equal amount of normal saline solution. Vision improved from light perception to 0.4 and 0.8 in these cases.

A most interesting third case, that of a soldier who was blind following spontaneous hemorrhages into the vitreous of both eyes, was courageously reported. Two needles were plunged into the vitreous chamber. Vitreous from a horse eye, enucleated 30 minutes before, was injected. Dor concludes: "This operation was not as simple as we had hoped. The needles from which we had hoped to see blood run became clogged and while injecting a little harder in the hope of clearing the second needle, we were able to produce only a painful hypertension of the eye. The result was absolutely nil. The patient returned two years later completely blind in both eyes, and we confess with regret that we had a pronounced hypotony in the eye we had hoped to cure while the other eye had a normal tension."

In 1929, C. A. Hegner⁹ reported an experiment that attracted much less attention than it deserved. He reported replacing all the cloudy vitreous that he could withdraw from a living human eye without undue suction or other trauma with an equal amount of cerebrospinal fluid from the same patient. In the first case vision improved from light percep-

tion to 20/20 by substituting 1.5 cc. of spinal fluid. Four other cases were reported and all were similarly improved, although normal vision was not restored.

In 1946, Norman L. Cutler,¹⁰ who had previously ascertained that rabbit vitreous could successfully be transplanted from one rabbit to another, reported three human cases in which he had substituted for 1.5 to 2 cc. of cloudy vitreous equal amounts of vitreous from donor eyes enucleated immediately beforehand in operating rooms under his control. In one case, vision was improved from light projection to 20/60—1, with a correcting lens, six months after operation. The second case was a failure as far as restoration of vision was concerned, but showed that the procedure could be done with impunity under these conditions. In the third case, that of a veteran with one eye, vision was improved from 20/300 to 20/20, with a correcting lens. In all cases the intraocular pressure remained normal.

In January, 1947, after considerable experimentation on refrigerated human eyes and live rabbit eyes, I had an opportunity to use cerebrospinal fluid to replace vitreous rendered cloudy with opacities due to hemorrhage. A search of the foreign and domestic literature resulted in the brief historic review herein presented and the discovery of Hegner's great experiment.

The reviews of Duke-Elder¹¹ and Red-slob¹² revealed the tremendous amount of work that has gone into the explication of what is now known about the human vitreous, the great gaps in our knowledge of its composition, physiology, and properties, as well as the barriers in the way of further understanding.

REPORT OF CASES

The technique of the operation is still being perfected and will be described in

detail in a subsequent publication. Special needles and syringes are being developed through the kindness and generosity of Becton, Dickinson & Company of Ruthersford, New Jersey.

The indications and contradictions for this operation are still to be determined fully. At the present time, any eye with a cloudy vitreous, not in an active state of uveitis, which has not improved under the usual conservative forms of treatment in a reasonable period of time, is considered suitable for this procedure. The patients or their parents were told of the experimental nature of the operation. All had a urinalysis, complete blood count, and a Wassermann test of the blood. Foci of infection were sought for and removed.

Case 1. S. G., a 13-year-old boy, was referred by Dr. David H. Webster as a possible candidate for replacement of a completely opaque vitreous by cerebrospinal fluid. The patient had been struck accidentally over the right eye through the closed lid in January, 1946. When the swelling of the contused lids had subsided sufficiently for them to be opened, it was found that the vision had been reduced to light projection from 20/20. A regime of topical applications to the eye, rest, hot compresses, and various subcutaneous injections of unknown medications failed to make any improvement in the vision in the 12 months following the accident.

Vision in the right eye was excellent light projection. There was no red reflex. Intraocular pressure was 21 mm. Hg (Schiøtz). The pupillary reaction was normal to light. Examination of the anterior segment under the slitlamp and corneal microscope was negative. The anterior vitreous was full of tiny red-gold opacities which had the appearance of hammered copper. Findings in the left eye were entirely negative, and the vision was 20/20.

On January 14, 1947, a spinal tap was done on the patient in bed. Cerebrospinal fluid (4 cc.) was withdrawn aseptically and carried to the operating room where it was transferred to the instrument tray.

Under pentothal anesthesia, the upper nasal quadrant of the right sclera was exposed through a conjunctival incision. A purse-string suture was placed at the puncture site about 12 mm. from the limbus. The special 18-gauge needle was plunged into the vitreous chamber and as much turbid vitreous as could be recovered by gentle suction and manipulation was withdrawn. This amounted to $1\frac{1}{4}$ cc. The globe collapsed as did the refrigerated human eyes upon which this operation had been done experimentally. Since no more vitreous could be recovered, approximately $1\frac{1}{4}$ cc. of the cerebrospinal fluid were injected. The needle point could immediately be seen clearly through the dilated pupil in the brightness of the overhead operating-room light. The purse-string suture was drawn up and tied as the needle was withdrawn and the conjunctival incision was closed. Examination with the ophthalmoscope at this point showed a clear channel in the hyaloid canal extending from the posterior lens capsule to the disc and macula, which could be seen with almost normal clarity. Dense opacities surrounded this clear channel. A 1-percent atropine-sulphate ointment and a dressing were applied to the right eye only.

The next day there was minimal conjunctival reaction and no pain or evidence of uveitis. The vision was 20/50—1, and the intraocular pressure to palpation through the closed lids appeared normal. The patient was allowed out of bed.

Three days later, the peripheral vitreous had begun to clear appreciably, tension was 19 mm. Hg (Schiøtz), and the vision was 20/40—1. On the fifth post-

operative day, the patient was permitted to go home.

Two weeks later, vision was 20/20 and the peripheral vitreous was clearer. The intraocular pressure felt normal through the closed lid, and there was no noticeable gross difference between the two eyes.

One month after the operation, vision was 20/20-1, the peripheral opacities had cleared still further, tension was 21 mm. Hg (Schiøtz), and the boy and his mother were tremendously pleased.

Case 2. I. D., a man, aged 58 years, was referred by Dr. R. Townley Paton as a patient who might be benefited by this procedure. The patient had an arrested case of pulmonary tuberculosis. Between 1941 and September, 1944, he had had 11 spontaneous retinal hemorrhages into the vitreous of the left eye with recovery of useful vision after each episode except the last, which had reduced the vision to light projection. He had received tuberculin injections for 16 months prior to this because it was felt that ocular tuberculosis might have been the cause of the hemorrhages.

Vision in the right eye was 20/20, with a +0.50D. cyl. 110° and a +2.50D. sph. added for work at 16 inches. The media were clear and, except for a mild sclerosis of the arteries and arteriovenous compression, the fundus was normal. Intraocular pressure was 22 mm. Hg (Schiøtz).

Vision in the left eye was faulty light projection. Intraocular pressure was 19 mm. Hg (Schiøtz). Examination of the anterior segment by slitlamp and corneal microscope was negative. The pupillary reaction to light was normal. The red reflex was absent. The anterior vitreous was full of strands of gray opacities.

On January 20, 1947, under pentothal anesthesia, a procedure identical to that performed on Case 1 was done, except that $1\frac{1}{2}$ cc. of cloudy vitreous were aspi-

rated without undue suction or trauma. A similar amount of cerebrospinal fluid was injected, but the point of the needle could not be seen, and at the conclusion of the operation, only the inferior temporal part of the vitreous seemed clearer.

A prompt recovery from the operation occurred, but the vision did not improve. The depths of the fundus could be seen dimly. Strands of proliferative retinitis and clumped choroidal pigment could be identified. Failure of vision to improve was attributed to retinal damage caused by repeated hemorrhages. For 48 hours after the operation, the patient saw a "round spot with a hole in it" at a point in his subjective visual field antipodal to the puncture site.

The patient left the hospital on the fifth postoperative day, and when seen four weeks later, had completely recovered from the operation. The visual acuity was unchanged, but the vitreous had cleared somewhat. Intraocular pressure was 16 mm. Hg (Schiøtz).

Case 3. J. C., aged 57 years, a housewife, was referred through the kindness of Dr. David H. Webster. She had had a spontaneous retinal hemorrhage into the vitreous at night, eight weeks before, and the upper half of the visual field was lost. The diagnosis lay between an inferior detachment and a neoplasm. Vision gradually deteriorated to light perception. Retinal detachment and retinal hemorrhage into the vitreous was the final diagnosis.

Vision in the right eye was light perception. The anterior segment was normal. The anterior vitreous was full of discrete, scintillating gold-brown particles. No red reflex could be obtained. The pupillary reaction to light was normal. Intraocular pressure was 11 mm. Hg (Schiøtz).

Vision in the left eye was 20/400, corrected to 20/20 with a +4.00D. sph.,

with a +2.75D. sph. added for work at 16 inches. The pupillary reaction to light was normal. The anterior segment was normal to examination by slitlamp and corneal microscope. The media were clear and the fundus was normal. Intraocular tension was 16 mm. Hg (Schiøtz).

On January 25, under pentothal anesthesia, 2 cc. of cloudy vitreous were withdrawn from the right eye and an equal amount of cerebrospinal fluid was replaced. No detail of the fundus of the eye could be seen immediately postoperatively, or from that time until the day of discharge, January 30, 1947. Vision was unimproved. Tension was 11 mm. Hg (Schiøtz) in the right eye, and 16 mm. Hg in the left eye.

The right eye was quite painful for three days after operation, and even though the withdrawn fluid was felt to be vitreous, it may well have been subretinal fluid.

Case 4. M. L., aged 58 years, was a private patient operated upon by Dr. Joseph Laval, who kindly gave permission for this case report. This patient had had a spontaneous hemorrhage into the vitreous of the right eye in June, 1942. Vision was gradually recovered until it approximated normal in June, 1946, when the patient was seen by Dr. Laval. At that time the systolic blood pressure on one reading was 168 mm. Hg. The retinal arterioles were moderately narrowed with an increased light reflex, and some arteriovenous compression. Terminal twigs at the maculas were tortuous.

In August, 1946, the patient returned to Dr. Laval because of a recurrence of the retinal hemorrhage into the vitreous of the right eye two weeks previously. Vision was reduced to light projection. Tension in both eyes was 20 mm. Hg (Schiøtz). Corrected vision in the left eye was 20/20. In the affected eye, the anterior segment was normal. The pupil-

lary response to light was normal. The anterior vitreous was full of strings of reddish, granular opacities.

At operation, under local anesthesia, done in the inferior nasal quadrant, 1¾ cc. of stringy black vitreous fluid were aspirated, and fresh blood appeared in the syringe at the end of the aspiration. An equal amount of cerebrospinal fluid was injected, but the needle could not be seen in the vitreous chamber and the reflex appeared black on immediate postoperative examination. There was no improvement for the remaining five days of hospitalization. There was no change in tension. Recovery from the operation was uneventful. No cause for failure can be ascertained so soon after operation.

SUMMARY AND CONCLUSIONS

That the substitution of cerebrospinal fluid for cloudy vitreous is practical has been established. Four patients on whom this operation was performed are reported. The youngest patient, aged 13 years, whose vitreous hemorrhage followed trauma, presented the most remarkable case in that one year after an ocular contusion, vision was improved from light projection to 20/20-1. The three other patients, whose ages were in the late fifties and who had had spontaneous retinal hemorrhages into the vitreous, showed no improvement in vision following this procedure. From these experiments, admittedly inconclusive because of the short period of postoperative observation, it is felt that the sphere of usefulness of this operation can only be extended by the further work of many ophthalmologists. Many cases of partial or complete blindness, due to vitreous opacities, have drifted away from proper ophthalmic care because of the discouraging results of more conservative treatments.

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SODIUM SULFACETIMIDE*

ITS USE IN TREATMENT OF CERTAIN DISEASES OF THE EYE

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In the search for a sulfonamide that was efficacious when applied locally for treatment of infections, Robson and Tebrich,¹ and Robson and Scott,²⁻⁵ all of Scotland, utilized the sodium salt of sulfacetimide in various concentrations in therapy of experimentally produced ulcers on the cornea of rabbits. Sodium sulfacetimide in 30-percent solution most nearly fulfilled their requirements for a drug with high solubility and adequate penetration, nonirritant effect, and a pH near the neutral point. Dickson⁶⁻⁸ followed up this experimental work by applying the drug in solutions of 10 percent and 30 percent, respectively, to injured eyes of a large number of coal miners and factory workers in Scotland. He was enthusiastic as to the results obtained with albucid soluble (sodium sulfacetimide)

and recommended its more widespread use in industry.

In the United States Kuhn,⁹ working in factories of Illinois and Indiana, used the drug extensively in the follow-up treatment of patients from whose corneas foreign bodies had been removed. By prescribing a 30-percent solution as eye drops for use every four hours, supplemented by application of the drug as an ointment at night, he was able greatly to reduce the incidence of secondary infection following extraction of a foreign body. Kuhn felt that sodium sulfacetimide was more efficacious than other drugs or methods in the treatment of traumatic corneal ulcers in the convalescent stage. To a lesser extent he utilized the drug in treatment of acute and chronic conjunctivitis.

During the past 12 months, certain patients observed in the Section on Ophthal-

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mology of the Mayo Clinic were treated with sodium sulfacetimide. This drug was utilized as the therapeutic agent in approximately 65 cases. The results obtained are reported herein.

For our clinical study we employed sodium sulfacetimide (albicid soluble)* as a 30-percent solution and a 10-percent ointment for the treatment of diseases of the external part of the eye other than those associated with trauma or foreign bodies. In those cases in which sodium sulfacetimide was administered, the treatment was not supplemented by use of any other medication. As controls, alternate patients received routine treatment. Cultures and smears to determine the conjunctival flora were not made as a routine, and no attempt was made to select patients for treatment with sodium sulfacetimide.

The drug gave best results in average cases of acute catarrhal conjunctivitis and acute conjunctivitis associated with purulent or mucopurulent discharge. We must agree with Kuhn's⁹ statement that "80% of cases were practically well within thirty-six hours if we saw them in the first twelve hours." Even those individuals who did not apply treatment within the first 12 hours of illness obtained relief from some of the symptoms of conjunctivitis. We employed either a 10-percent ointment or a 30-percent solution every two hours in the treatment of these conditions. The solution seemed to give better results than the ointment. In cases of conjunctivitis with a secondary superficial keratitis or corneal ulcer, the ointment was more soothing than the solution. In these types of disease of the eye, the results obtained by use of sodium sulfacetimide were better than those obtained by use of mercurial solutions, peni-

cillin, or other drugs of the sulfonamide group.

The results obtained in treatment of chronic types of catarrhal and follicular conjunctivitis were less startling than those obtained in treatment of acute varieties. However, the subjective alleviation of symptoms was remarkable; in fact, it was more striking than objective improvement. It was our impression that the duration of the chronic phase of conjunctivitis in cases in which sodium sulfacetimide was used was shortened as compared to that of cases in which other methods of treatment were used.

In treatment of blepharoconjunctivitis the drug was used both as a solution and an ointment; the solution was applied during waking hours and the ointment at night. Requests were received from some of the patients for an additional supply of the medicine several months after their departure from the clinic. Although this fact suggests that the patients approved use of the drug, it also indicates that the disease was still present. For the treatment of blepharoconjunctivitis, we do not feel that methods in which this drug is employed are superior to others but that the drug should be accepted as one, among others, that gives reasonably good results.

We employed sodium sulfacetimide in some cases of keratitis sicca complicated by secondary conjunctivitis. The drug promptly alleviated the conjunctivitis and brought patients a great deal of relief during the phase when artificial-tear solutions alone were inadequate.

In treatment of angular conjunctivitis, we did not find the drug superior to the usual preparations of zinc. In cases of vernal conjunctivitis and primary keratitis uncomplicated by conjunctivitis or corneal ulcer, the drug seemed to have no effect. There was no opportunity to test the effect of locally-applied sodium sulfacetimide on trachoma.

* The drug for this clinical survey was kindly furnished by Schering Corporation.

Sodium sulfacetimide was used successfully as a collyrium in some cases in which other drugs had produced dermatitis of the eyelids. Sensitivity to sodium sulfacetimide developed in one case; in practically all cases, however, the patients used a 30-percent solution with little complaint. In many instances a 30-percent solution was said to produce a burning sensation momentarily. Because of the high concentration of the drug in solution, a fine white precipitate usually appears on the cap of the dropper bottle and on the eyelashes. The patients always were warned of the tendency of this drug to precipitate.

The work of Kuhn, Dickson, and others would seem to indicate that sodium sulfacetimide should be used more widely

than it is now for treatment of posttraumatic corneal ulcers occurring among industrial workers. Our experience with the drug indicates that it is safe and efficacious for routine use in many types of conjunctivitis occurring in patients seen in private practice.

CONCLUSION

A drug, sodium sulfacetimide (Schering Corporation), prepared as a 30-percent solution and a 10-percent ointment, was utilized in the treatment of certain diseases of the external part of the eye during the past year. The drug was found safe for average clinical use and seemed most efficacious for treatment of acute varieties of catarrhal and purulent conjunctivitis.

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ANTITOXIN TREATMENT OF STAPHYLOCOCCIC CORNEAL ULCERATION*

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Corneal lesions occurring in the course of staphylococcic blepharoconjunctivitis are of two varieties. One, superficial punctate epithelial keratitis, is frequently encountered during acute exacerbations of the conjunctival lesion. With adequate treatment of the conjunctivitis, the keratitis subsides without sequelae. The second and more serious corneal complication also occurs during an acute exacerbation of the conjunctivitis. It is characterized by the development of marginal corneal ulceration with underlying stromal infiltration, accompanied by iritis (figs. 1, 2, and 3) and unless brought under control may progress to the development of a ring ulcer of the cornea. This course was observed in one case resulting in loss of the globe and in stimulating a search for better treatment.

The logical therapeutic agent seemed to be antitoxin since corneal lesions had been produced experimentally by the instillation of staphylococcus toxin¹ onto the cornea. Therefore, 25 patients, all of the cases seen in the eye clinic between September, 1937, and September, 1940, with staphylococcic blepharoconjunctivitis and marginal corneal ulceration, were treated with antitoxin. The only additional treatment was the instillation of 0.2-percent aqueous solution of scopolamine hydrobromide onto the cornea to relieve photophobia.

After the etiologic diagnosis had been

established, antitoxin was administered by daily intramuscular injections of 10,000 units. A total of 40,000 units was given to 22 patients; 50,000 units to one patient; 60,000 to one and 80,000 to another (tables 1, 2, and 3).

All of the patients in the series had blepharoconjunctivitis of both eyes; 11 had superficial punctate epithelial keratitis of one cornea and marginal ulceration with stromal infiltration in the other; the remaining 14 had the more severe corneal lesions in each eye. Little change was observed 24 hours after the first injection of antitoxin. However, definite improvement occurred within 48 hours. Conjunctival discharge and congestion diminished; superficial punctate epithelial lesions of the cornea decreased in number; and the corneal ulcers and infiltrations became smaller. Thereafter, improvement continued slowly in several cases and rapidly in a few. The majority of the corneal ulcers healed and the infiltrations disappeared in 5 to 7 days after the first injection of antitoxin (figs. 3 and 4). In three cases, healing occurred in three days; whereas, in two cases the lesions persisted for 10 days (see tables). Although superficial corneal scarring remained at the site of the ulcers, it was marginal and did not result in the loss of visual acuity in any patient.

In addition to the ocular lesions, one patient had an extensive sycosis vulgaris; two had an acneiform eruption of the skin; and one had impetiginous lesions of the face. All of these manifestations regressed simultaneously with the improvement of the ocular lesions.

Before treatment, sensitivity tests were

*From the Department of Ophthalmology, College of Medicine, State University of Iowa, Iowa City, Iowa. Part of a study conducted under grants from the John and Mary R. Markle Foundation. Read at the 82nd Annual Meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.

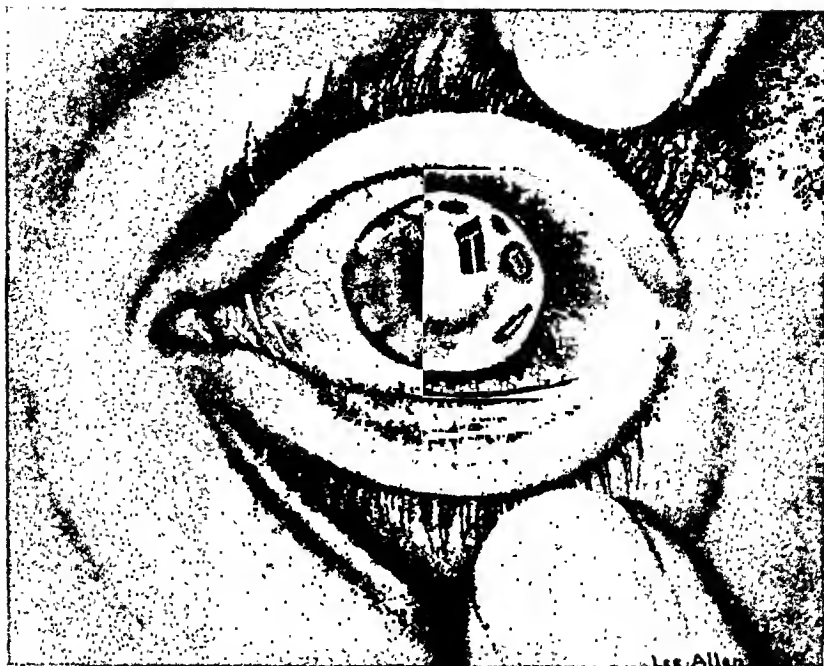


Fig. 1 (Allen). Marginal corneal ulceration and stromal infiltration in an acute exacerbation of staphylococcic blepharoconjunctivitis.



Fig. 2 (Allen). Marginal corneal ulceration and stromal infiltration in an acute exacerbation of staphylococcic blepharoconjunctivitis.

made on each patient by injecting 0.1 cc. of horse serum intradermally into one forearm and 0.1 cc. of the antitoxin intradermally into the other forearm. Although no hypersensitivity was revealed, 5 of the 25 patients developed serum reactions. The first and second patients

developed severe serum sickness with high fever, lymphadenopathy, generalized aches and pains, stiffness of the joints, and rash over the abdomen, chest, and neck. These reactions subsided without sequelae. Three other patients had mild transitory reactions. One noticed hives

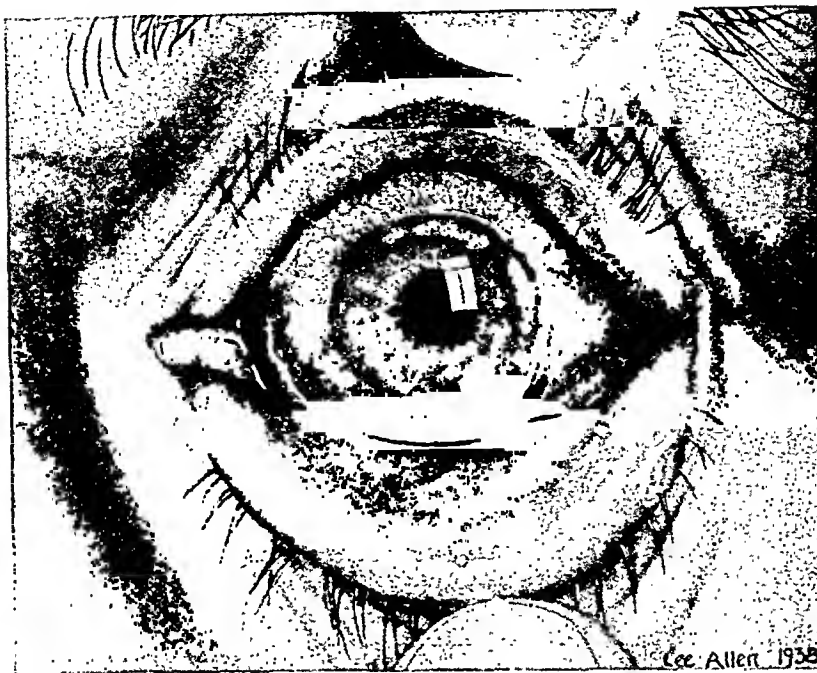


Fig. 3 (Allen). Appearance of left eye in Case 3 (table 1) before antitoxin treatment.

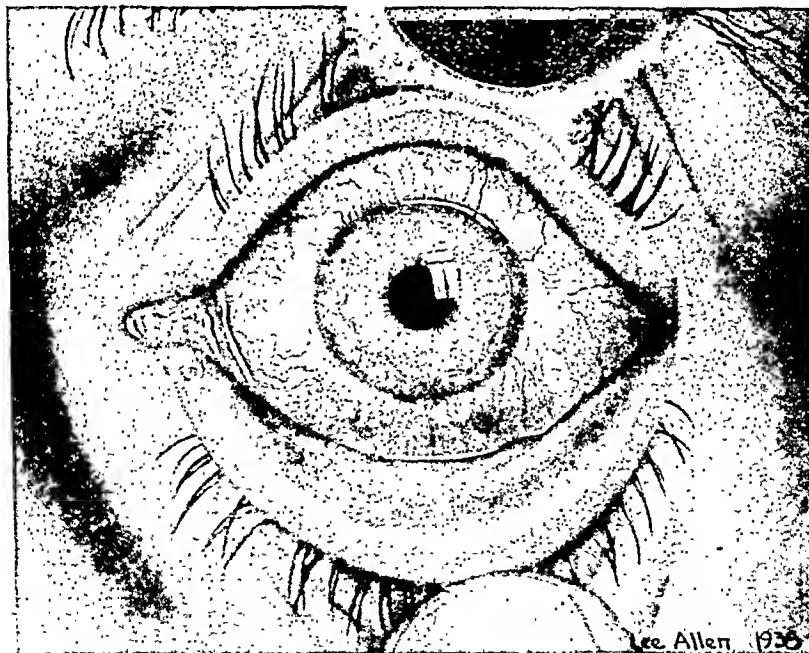


Fig. 4 (Allen). Appearance of left eye in Case 3 (table 1) seven days later.









in the region of the injections on the hips and at the sites of the skin tests on the arms four days after the first injection of antitoxin. The other two developed pain and stiffness of the joints associated with moderate elevation of temperature for one day on the 7th and 8th days after the first treatment.

Bacteriologic studies including aerobic and anaerobic cultures, scrapings, and secretion smears were made on these patients before, during, and after antitoxin treatment. Only staphylococci and occasionally *Corynebacteria xerosis* were found. In 23 cases the staphylococci were *aureus* and in two, *albus*. All strains

were hemolytic, fermented mannitol, and produced potent exotoxin. During and after treatment with antitoxin, there was no apparent reduction in the number of staphylococci.









lished after the corneal lesions healed. In 22. patients; the remaining conjunctival lesions slowly regressed. In one patient, a slight superficial punctate epithelial keratitis appeared 24 hours after the first

TABLE 1
SUMMARY OF CASES

CASE NO.	SEX	AGE	TYPE OF STAPHYLOCOCCUS	DURATION		LESIONS O.D. O.S.	UNITS OF ANTITOXIN	CORNEAL LESIONS HEALED	SERUM REACTION
				TOTAL FOR CONJUNCTIVITIS	ACUTE EXACERBATION				
1	M	31	AUREUS	1 YEAR	1 WEEK		50,000	3 DAYS	SEVERE
2	"	13	"	2 YEARS	1 "		40,000	10 "	"
3	"	66	"	10 "	10. DAYS		"	7 "	NONE
4	"	25	"	SEVERAL MONTHS	15 "		"	3 "	"
5	"	55	"	6 MONTHS	15 "		"	3 " *	"
6	"	37	"	7 YEARS	3 "		"	5 "	"
7	"	49	"	2 "	3 MONTHS		"	5 "	MILD
8	F	67	"	3 WEEKS	3 WEEKS		"	10 "	"

* SUPERFICIAL ULCERATION OF LEFT CORNEA OCCURRED AFTER EACH OF FIRST 5 INJECTIONS OF TOXOID.

TABLE 2
SUMMARY OF CASES

CASE NO.	SEX	AGE	TYPE OF STAPHYLOCOCCUS	DURATION		LESIONS O.D. O.S.	UNITS OF ANTITOXIN	CORNEAL LESIONS HEALED	SERUM REACTION
				TOTAL FOR CONJUNCTIVITIS	ACUTE EXACERBATION				
9	M	47	AUREUS	SEVERAL YEARS	2 WEEKS		40,000	5 DAYS	NONE
10	"	72	"	"	1 WEEK		"	5 "	"
11	"	62	"	4 YEARS	"		"	6 "	"
12	F	54	"	SEVERAL WEEKS	SEVERAL WEEKS		"	6 "	"
13	"	58	"	8 WEEKS	8 WEEKS		"	5 "	"
14	M	72	"	SEVERAL YEARS	1 WEEK		"	5 "	"
15	"	38	"	1 MONTH	1 MONTH		"	9 " *	"
16	F	59	ALBUS	9 YEARS	2 WEEKS		"	5 "	"

* ULCER OF LEFT CORNEA OCCURRED WITH FIRST INJECTION OF TOXOID AND BECAME SEVERE, REQUIRING FURTHER ANTITOXIN TREATMENT

Because of the persistence of exotoxin producing staphylococci upon the conjunctiva and the transitory nature of antitoxin therapy, active immunization with staphylococcus toxoid was estab-

lished after the corneal lesions healed. It was associated with an exacerbation of the conjunctivitis. However, these lesions subsided rapidly and no further recurrences developed. Another patient developed a transitory

exacerbation of conjunctivitis associated with superficial ulceration of the cornea in the site of the previous corneal lesion after each of the first five injections of toxoid. A third patient, however, had an acute recurrence of all manifestations, including marginal corneal ulceration after the first injection of toxoid. The lesions were so severe that he was given antitoxin again, and combined toxoid and

severe staphylococcic infections to prevent permanent and irreparable damage to the cornea and should be followed by active immunization, chemotherapy, or antibiotic therapy.

Since this study was made, penicillin has proved to be effective in the treatment of many staphylococcic infections. However, Thygeson² has reported that approximately 20 percent of the strains of

TABLE 3
SUMMARY OF CASES

CASE NO.	SEX	AGE	TYPE OF STAPHYLOCOCCUS	DURATION		LESIONS		UNITS OF ANTITOXIN	CORNEAL LESIONS HEALED	SERUM REACTION
				TOTAL FOR CONJUNCTIVITIS	ACUTE EXACERBATION	O.D.	O.S.			
17	M	61	ALBUS	2 MONTHS	2 MONTHS	○	○	80,000	7 DAYS	NONE
18	F	31	AUREUS	1 YEAR	1 WEEK	⊙	⊙	40,000	6 "	"
19	M	22	"	"	10 DAYS	○	○	"	6 "	"
20	"	73	"	"	1 WEEK	⊙	⊙	60,000	6 "	"
21	"	37	"	3 YEARS	"	⊙	⊙	40,000	7 "	"
22	"	38	"	5 MONTHS	"	⊙	⊙	"	5 "	MILD
23	"	52	"	1 YEAR	"	⊙	○	"	5 "	NONE
24	"	36	"	24 YEARS	"	○	○	"	5 "	"
25	F	20	"	1 YEAR	2 WEEKS	○	○	"	5 "	"

antitoxin treatment was continued until 140,000 units of antitoxin had been given before the exacerbations were controlled.

DISCUSSION

The rapid response of both the conjunctival and corneal lesions to the administration of antitoxin furnishes clinical proof for the theory that toxin is an important factor in the production of staphylococcic conjunctivitis and corneal ulceration. The recurrence of superficial epithelial keratitis in two patients and severe corneal ulceration in a third, following the administration of toxoid, is further proof of the causative role of toxin.

Inasmuch as antitoxin therapy is transitory, it is of practical value only in

staphylococci isolated from the eye are resistant to penicillin. Therefore, antitoxin therapy should be useful in severe infections caused by penicillin-resistant strains of staphylococci.

SUMMARY

The acute manifestations of staphylococcic blepharoconjunctivitis complicated by corneal lesions subsided under antitoxin treatment in a series of 25 patients. Minor corneal lesions recurred in two cases, and severe corneal ulceration reappeared in one case immediately following the institution of toxoid therapy. Serum reactions occurred in 5 of the 25 patients even though skin tests failed to reveal hypersensitivity.

CONCLUSIONS

Both the response to antitoxin therapy and the relapses following the institution of toxoid therapy furnish clinical proof for the theory that toxin is an important factor in causing the acute lesions in staphylococcic ocular infections.

Antitoxin is of practical value as a temporary measure in the treatment of severe staphylococcic infections until active immunization, chemotherapy, or antibiotic therapy can become effective.

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MEDICAL ASSISTANCE AT PROFESSIONAL LEVEL*

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Resultant of multiple factors, there is a shortage of physicians, and this shortage will continue for some years. How to extend medical care has, therefore, become the concern of many well-meaning people. The problem of more and better distribution of medical care is not likely to be met by any of the conventional measures and methods now in sight.

Lay interest has been and is largely political. Up to this time, it fails to tie threatened government aggressions with responsibility. The profession itself is taking various measures to overcome the shortage of physicians and their services. Among these measures are larger classes at undergraduate level, an increase in the number of residents and internes, provision for more fellowships, refresher courses, and basic-training programs in the specialties. Constantly improving methods of treatment and prevention of

disease, the aftermaths of research and education, also give more, as well as better, medical care. Furthermore, medicine has trained certain lay people to care for the sick. Within this classification is the nurse; for the function of the nurse, when trained by medicine and practicing under its laws, is to care for the sick. Laboratory aides, X-ray technicians, office workers, and special workers in research, all trained in medical disciplines, have greatly enlarged the extent and the effectiveness of medical practice.

Despite all the above medically trained laymen, do we in ophthalmology have sufficient technical and professional assistance? Ophthalmology has not seriously gone into the problem of training high-level assistants except in orthoptics. The orthoptic technicians are excellent as far as they go, but they have a narrow range. Their opportunities for assistance are too limited, and the supply is restricted because recognized training centers are too few. Yet, ophthalmology in its various segments probably more than any other specialty is adaptable to professional assistance. Although both the already numerous methods of examination and the complications of instruments are increasing,

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no serious effort has been made to train a professional personnel, with the exception of orthoptics.

The obvious question arises—is it desirable to create such a group of medical assistants? Medicine has always been reluctant to teach lay people in the field of practice. This wariness is simply a protection to the public and aims to avoid increased health problems from low standards and quackery, for there have always been those at the fringe of Medicine who see many people.

For 2,500 years, an item in our code has been and now is to teach only those who follow and are controlled by the laws of Medicine. The current procedure of those groups operating on the fringe of Medicine is to write their own rules for their own advantage and economic administration. Using medical symbols, they continually press for more and more legal recognition, so that legal acceptance has come to possess but little professional merit in problems of health.

Schools, the military, industry, and civic organizations are badgered by these activities. The principles and the practice of caring for the sick are not, however, subject to short cuts in education or ethics. To achieve medical acceptance and to merit medical instruction and teaching, a lay group must accept and work within the laws of Medicine. The nurse has achieved this recognition.

A consistent and common pedagogic function of the physician is to train lay assistants by preceptorships. These persons, bound to the principles of Medicine by the physician's high standards and disciplines, greatly extend the range of his practice and reduce the onus of his daily grind. The overall effect is to extend high-level services over a larger number of patients. The gathering of data relating to the ocular health of an individual is sometimes a long and laborious

process. Consequently, a medically educated and accredited personnel, trained to assist in this work, will extend the ophthalmologist's service and ease the burden of his practice.

What should be the educational scope of these assistants? The answer to this question has direct bearing on the possible contacts they may have with the overall practice of the ophthalmologists. While doubtless there would not be complete agreement as to which parts of the examination could be conducted by assistants, some ophthalmologists would assign one part and some others, still the following parts of an eye service may be listed as suitable for assignment to medical assistants at a professional level.

Refraction. Instillation of drops, shadow and subjective tests, not the history, muscle balance, tonometry, external and ophthalmoscopic examination, and prescription.

External diseases. Smears and cultures, some forms of therapy under supervision, photography if indicated.

Perimetry. Visual fields and scotometry.

Tonometry. Under supervision.

Orthoptics. The conduct of fusion training.

Ophthalmoscopy. Assistance in photography when indicated, note taking.

Biomicroscopy. Assistance in placing the patient, drawings and notes.

Gonioscopy. Assistance in placing the patient, drawings and notes.

Ocular Motility. Assistance in plotting and recording fields, and note taking.

Screening tests. In schools and industry.

Surgical. The care and preparation of instruments, assistance during the operation.

First Aid. In industry and schools.

Laboratory. Smears and cultures, tis-

sue sectioning, chemistry data recording, preparation of drugs and solutions.

Contact Glasses. Assistance in refraction and fitting of trial shells and molds.

Library. Collection of abstracts and references, assistance in preparation of papers.

Nursing Care. On occasion.

In practice most of us delegate parts of the examinations to trained personnel. This assistance is trained by the preceptor method—a method which requires many years and does not turn out enough well-rounded, trained people to meet the demands or the possibilities. From the experimental point of view, the preceptor-trained associate is a success. To increase their numbers, approved academic channels may be used. The admittance standards to the course of study leading to an ophthalmic associationship would be those of college entrance, plus aptitude. The suggested curriculum would run four years at college level and lead to a bachelor's degree. About half of the subject matter would be in the field of the humanities and would be taught by the literary and science faculties. History, English, and languages, biologic and social sciences would be conventionally proportioned. The last two years would be chiefly concerned with technical training and would be the responsibility of the medical teaching staff.

A technical curriculum is suggested in this outline of subjects and hours for the Junior and Senior years.

<i>Subject</i>	<i>Hours</i>
(Lecture & Laboratory)	

FIRST SEMESTER—JUNIOR YEAR

Anatomy—gross, head, neck, dissections. Includes comparative and embryology	240
Neuroanatomy	88
Bacteriology	72
Physiologic Chemistry	216
Histology of the Eye	144

SECOND SEMESTER—JUNIOR YEAR

Psychiatry and Neurology	72
Physiology	216
Physiologic Optics	72
Pathology	216
Use of Medical Library	2
Clinical and Laboratory Technique	144

FIRST SEMESTER—SENIOR YEAR

Refraction	288
Ocular Muscles	72
Orthoptics	140
Optical Manufacture	100
Contact Lens	20
Perimetry	200

SECOND SEMESTER—SENIOR YEAR

Biomicroscopy	12
Refraction	288
Tonometry	4
Orthoptics	140
Screening Methods	100
Nursing—Ophthalmic	50
Surgical Equipment	100
Medical Illustration	100
Office Practice	50
Statistics	10

CONCLUSIONS

The development of a professional group of ophthalmic associates will make a substantial contribution to medical care in our specialty. It can be created within existing educational facilities. The suggested program would run four years at college level and lead to a bachelor's degree. About half of the subject matter lies in the field of the humanities and would be taught by the literary and science faculties. The remainder is largely technical and is the responsibility of the medical teachers. The admittance standards would be those of college level plus aptitude. On successfully completing this course, the rewards to the associate and his acceptance by medicine should be consistent with his training, ability, and responsibilities. If the formation of this group within our field has survival value, it will be because it extends medical service and is better for the patient.

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THE USE OF FURMETHIDE IN COMPARISON WITH PILOCARPINE AND ESERINE FOR THE TREATMENT OF GLAUCOMA*

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The results of the use of furmethide (furfuryl trimethyl ammonium iodide) in the treatment of glaucoma have been reported in two previous papers.^{1,2} When these papers were published, furmethide was available only in small quantities, but it now appears that the drug will become available commercially. The purpose of this paper is to compare furmethide with the conventional drugs, pilocarpine and eserine, in the treatment of primary glaucoma.

The results in a group of 60 cases of primary glaucoma treated with pilocarpine and eserine were compared with the results in a group of 65 similar cases treated with furmethide. The ocular tension in all cases of both groups exceeded 40 mm. Hg (Schiotz) before therapy. Cases of both congestive and noncongestive glaucoma were included in both groups. All of the patients were admitted to the hospital.

METHODS OF TREATMENT

The methods of treatment in the pilocarpine and eserine group were not as uniform as in the furmethide group. In the latter, all patients received one drop of a 10-percent solution of furmethide instilled into the conjunctival sac every 15 minutes for 2 hours, then every 3 hours until the tension had been reduced to normal, or until an operation had been performed. The methods of treatment in the pilocarpine and eserine group may be summarized as follows:

Pilocarpine (2-percent solution). 22 cases. Usually given every 2 hours; occasionally every hour or every 3 hours; rarely every 30 minutes for 4 doses, then every 3 hours.

Pilocarpine (1-percent solution). 7 cases. Usually given every 2 hours or every 3 hours; rarely every hour.

Pilocarpine and Eserine. 24 cases. Usually pilocarpine (2-percent solution), occasionally pilocarpine (1-percent or 5-percent solution) alternating with eserine (0.25-percent solution) every 2 hours; occasionally pilocarpine (2-percent solution) and eserine (0.25-percent solution) every 15 minutes for 1 hour, then every 2 or 3 hours.

Eserine. 7 cases. Usually eserine (0.25-percent solution), rarely eserine (0.50-percent or 1-percent solution) every 15 minutes for 1 hour, then every 3 hours.

RESULTS

The results are summarized in Table 1.

1. In the pilocarpine and eserine group (60 cases) the tension was reduced to 35 mm. Hg (Schiotz) or less in 53 percent of the cases as compared with a similar reduction of tension in 77 percent of the cases treated with furmethide. This is statistically significant ($t = 2.9$).

2. Tension before therapy was over 55 mm. in 47 percent of the patients in the pilocarpine and eserine group. In the furmethide group, however, the initial tension was over 55 mm. in 62 percent of the patients. Thus furmethide was used in a group with higher initial tensions.

Comparison of the figures in Table 1 shows that furmethide was more effective than pilocarpine and eserine in treating

*From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University.

cases with initial tensions over 55 mm. ($r = 2.7$). It also appears to be more effective in treating patients with initial tensions less than 55 mm., although the results are not quite statistically significant ($r = 1.5$).

glaucoma whose tension had been uncontrolled by pilocarpine. The group included cases of congestive and noncongestive glaucoma. Before furmethide therapy was started the tension had been consistently elevated, varying from 30 to

TABLE 1

COMPARISON OF THE FAVORABLE EFFECT OF TREATMENT WITH FURMETHIDE AND WITH
PILOCARPINE AND ESERINE ON VARIOUS STAGES OF PRIMARY GLAUCOMA:
PERCENTAGE REDUCTION OF TENSION TO 35 MM. OR LESS

Treatment	Initial* Tension over 55 mm. Percent	Initial Tension under 55 mm. Percent	Late Cases Percent	Early Cases Percent	Total* Percent
Furmethide	75	80	67	79	77
Pilocarpine and Eserine Group	43	63	52	57	53

* Statistically significant difference in percentage.

3. Early and late glaucoma. The patients were divided into two groups, those with so-called early and late glaucoma. Cases of early glaucoma were considered to be those in which the field defect was less than 30 degrees in any meridian and the blind spot not enlarged more than 10 degrees in any diameter. According to this classification, 65 percent of the cases in the pilocarpine and eserine group had late glaucoma. In the furmethide group 70 percent of the cases had late glaucoma.

The table shows that furmethide was more effective than pilocarpine and eserine in treating both early and late cases, although the differences are not quite statistically significant: ($r = 1.4$) in the early cases, ($r = 1.5$) in the late cases.

COMMENT

Furmethide was also used in a separate group of 20 outpatients with primary

40 mm. Hg (Schiotz). In half of these patients the tension was reduced to normal (25 mm. or less) by furmethide given in 10-percent solution from 3 to 6 times a day. As previously reported, these figures show that furmethide is effective in controlling the tension in certain cases where pilocarpine has failed.

CONCLUSIONS

1. Furmethide is more effective than pilocarpine and eserine in the treatment of cases of primary glaucoma in which the tension before therapy exceeds 40 mm. Hg (Schiotz). It is especially valuable in cases in which the initial tension exceeds 55 mm. Hg (Schiotz).

2. Furmethide is effective in certain cases of primary glaucoma in the lower tension groups in which treatment with pilocarpine has failed.

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CEPHALOSPORIUM KERATITIS*

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"Fungus infections are of such common occurrence that we have found it necessary to consider mycotic disease in the differential diagnosis of practically every obscure infection." With these words the authors of the *Manual of Clinical Mycology*¹ preface their excellent presentation.

Ophthalmologists have, as usual, been alert and able to suggest the methods of examination to prove the diagnosis of several of the mycoses such as the rare sporotrichosis and the common blastomycosis.

The physicians of the United States are now more fungus conscious than ever before, not only because more cases have been seen, but also because they are apprehensive that when the infected return from the Pacific they may spread the disease. So far this fear has not been justified.

Serra,² in 1929, reported the first case of ocular cephalosporium, a keratitis. He carried his cultural examination to a logical and exact termination. Maffei³ confirmed Serra's observations and extended their scope.

Correlated and suggestive studies have been recorded by Morax⁴ of a corneal ulcer with hypopyon caused by the *verticillium graphii*, and by McKee⁵ in blastomycosis. An interesting citation of corneal involvement, caused by *glenspora graphii*, somewhat similar to the cephalosporium, was made by R. E. Wright.⁶ The corneal slough was tough, with a slightly undermined edge and a grayish-yellow, tightly adherent central mass. Lundsgaard⁷ reported a hypopyon

keratitis with a mould and Stoewer⁸ experimented with moulds in rabbits' eyes.

When, in 1932, Miller and Morrow⁹ wrote about cephalosporiosis, they found only five cases in the literature, three gummalike and two superficial skin. Hartmann¹⁰ called attention to the association of cephalosporium and trichophyton gypseum.

Other observers including Lewis and Hopper,¹¹ Grutz,¹² Boucher,¹³ Benedek,¹⁴ Cabrini and Redaelli,¹⁵ Leao and Lobo,¹⁶ Klebahn,¹⁷ and Beym¹⁸ have had clinical and laboratory experience with the various types of cephalosporium.

The most complete presentation is by Dodge.¹⁹ Other recommended sources of information on the mycoses are the works of Ash and Spitz²⁰ and the *Manual of Clinical Mycology*¹ under the authorship of Conant, Martin, Smith, Baker, and Callaway.

CASE REPORT

A 41-year-old, rugged farmer was examined 10 days after his left eye had been injured when struck by a cow's tail. The cow was healthy and the accident such a common one that no attention was paid to it until the day before he was first seen when the eye became painful, red, and sensitive to light.

The right eye was negative externally. Vision in this eye was: 6/15 +2.50 6/5. Vision in the left eye was 6/15. The lids were red and swollen and the entire bulbar and palpebral conjunctiva was congested. The injection was greatest in the lower cul-de-sac and on the proximate globe. The cornea was clear, except in the lower outer quadrant where a 3-mm. gray ulcer with a soft, ill-defined margin was close to the limbus. The iris was congested, the

*Read at the 82nd annual meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.



Fig. 1 (Bedell). Yellow-white corneal ulcer with a furred margin; hypopyon, ciliary congestion.

pupil measured 2.5 mm. and responded actively to light, although it only dilated to 4 mm. after the instillation of atropine. The aqueous was cloudy but there was no hypopyon.

Three drops of the aqueous solution of 5-percent sodium sulfathiazole were instilled into the lower cul-de-sac every two hours. After three days, the ulcer was unchanged. The entire area was then treated with tincture of iodine without any improvement. Penicillin (2,500 units to 1 gm. of white ointment) was put into the eye every hour, and under this treatment the infiltration increased.

The 3-mm. corneal ulcer was covered by a yellow-white, slightly wrinkled plaque. The peripheral portions were thickest and seemed to furl away from



Fig. 2 (Bedell). Five days later. Marked improvement. Ulcer less yellow, more circumscribed, hypopyon decreased.

the uninvolved surrounding cornea. There was a 2-mm. hypopyon, and the bulbar congestion continued to be greatest below. The culture yielded staphylococcus albus and a few Gram-positive cocci. The appearance of the ulcer was so suggestive of a mould growth that, although previous attempts to cultivate one had failed, potassium iodide was given internally.

Five days later, the improvement was sufficient to confirm clinically the diagnosis of mould. The ulcer was not only softer and more yellow, but was also markedly reduced in surface and depth. It was less than one half its former size and the hypopyon was about one quarter as large as formerly. The patient was taking 15 gr. of potassium iodide, three

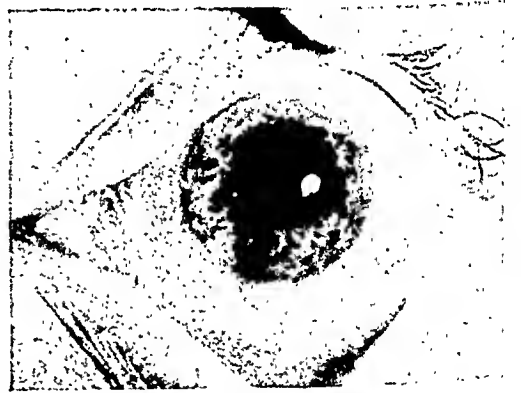


Fig. 3 (Bedell). Ulcer healed, thin scar, pupil dilated.

times a day. The cultures which proved the diagnosis were taken at this time.

Three days later there was no hypopyon and the corneal area was gray and slightly depressed.

When seen nine days later, the globe was whitening and the corneal facet had a smooth, light-reflecting base.

The improvement continued. When last examined, uncorrected vision was 6/12; and corrected vision was 6/6, with a +2.00D. sph. \ominus +50D. cyl. ax. 180°. The corneal surface was smooth, and only a nebulous, round, superficial scar remained. The pupil was slightly irregular

with a fine arc of uveal pigment on the lens capsule.

LABORATORY REPORT

The report from the Albany Hospital and the Albany Medical College Laboratory by Dr. William Kaufman was:

"Cultures were taken on December 22, 1945. Two tubes of Sabouraud's dextrose agar and two tubes of cornmeal agar were inoculated. Growth on both media occurred after 24 to 36 hours at room-temperature incubation. Growth occurred rapidly and within five days the slants were completely overgrown. Forty-eight hours after inoculation, two Kille flasks, one containing Sabouraud's dextrose agar and the other containing cornmeal agar were inoculated with material grown on the slants. Growth occurred within 24 to 36 hours, and within one week the flasks were completely covered with the growth.

"Gross appearance of the Sabouraud-inoculated material (fig. 4): The colony is cottony and whitish with a slight pink sheen. There is a moderate amount of aerial growth.

"Gross appearance of the cornmeal-

inoculated material: The colony is grayish-white, more granular than the former, and there are few, if any, aerial hyphae. Growth shows distinct purplish pigment.

"Microscopic examination of material



Fig. 5 (Bedell). Unbranched conidiophores with many elliptical conidia.

removed from the Sabouraud medium (fig. 5): There are numerous septate hyphae containing a fair number of granules. Racquet mycelium is frequently observed. A few hyphae containing arthrospores are seen. There is an abundance of ovoid spores (conidia). These are seen to grow laterally from the hyphae in groups of one or sometimes two, and in grapelike clusters from the end of the hyphae. Many of the conidia are often elongated and a large number are seen completely round and containing what appear to be crossbars, and these bars are found centrally as well as at the end of the conidia. There is considerable variation in size of the conidia. Occasional chlamydospores are seen.

"Diagnosis: *Cephalosporium* species."

COMMENT

A corneal ulcer, the result of an abrasion caused by a cow's tail, is described.

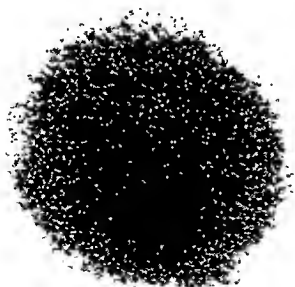


Fig. 4 (Bedell). Cottonlike growth with a fuscous tinge, after 36 hours' incubation on Sabouraud's media.

The first laboratory report was staphylococcus albus and a few Gram-positive cocci. The usual treatment including sulfathiazole and penicillin failed to check the infection. The clinical picture was so suggestive of a mould that potassium iodide was administered and a very satisfactory regression resulted. Subsequent investigations proved that the cause was the extremely rare cephalosporium species.

This cephalosporium infection of an eye is the second on record, for after a careful research of the literature only the case of Serra seems substantiated.

The response to potassium iodide was spectacular.

CONCLUSION

Any chronic corneal ulcer with a puckered plaque should be cultured for moulds.

I am indebted to Dr. Nathan Mitchell who zealously coöperated in many experiments on the cornea of rabbits. No exact duplication of the human ulcer was obtained, although the mould-infected cornea reacted more severely than the control.

344 State Street (6).

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FURTHER RESEARCH ON PANNUS FOLLICULARIS TRACHOMATOSUS

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In former publications,¹ I have attempted to prove that pannus trachomatosis is not always a simple "keratitis vasculosa superficialis," as it has often been designated, but a *follicular hyperplasia of the corneal conjunctiva*.

Since the publication of my early discussions of this question, the existence of follicular pannus has been confirmed by other authors also.² Nevertheless, I have continued my researches on a large scale and have found follicles in many cases of pannus trachomatosis, especially in its denser formations. The last of these observations demonstrates most clearly this thesis and should be recognized by all modern trachomatologists throughout the world. Its recognition is the more important in that such cases have become very rare in Bulgaria also, just as they have disappeared from many other countries of Europe.

CASE REPORT

M. D. K., a girl aged 18 years, led by her mother because she was blind, entered the University Eye Clinic on May 20, 1939.

Four years previously her eyes had begun to water and to be red. The condition became worse, as the months passed, and her vision began to diminish. During this time she was operated on by an ophthalmologist who expressed the conjunctival granulations.

After the operation she was improved and could still see. Six months later, her vision began progressively to fail; first in the right eye, then in the left. As stated, at the time of her admission to the Clinic vision was nil.

Examination. The patient was tall and

of a weak constitution. She had suffered for some time from malaria. X-ray studies of the chest showed a tracheobronchial adenopathy with calcification of the glands of the left hilus. The Weil-Felix reaction was negative.

Blood studies gave the following results: R. B. C., 4,190,000; W. B. C. 6,500; hemoglobin, 78 percent; polymorphonuclears 60 percent (rods, 1 percent; segmented, 59 percent); lymphocytes, 34 percent; mononuclears, 4 percent; eosinophiles, 2 percent. The urine was normal.

Eye examination. A pronounced symptomatic ptosis with increased conjunctival secretion was observed. The conjunctiva of the superior tarsus was thick, rough, and toward the upper end, gelatinous in appearance. The same pathologic change was found in the lower lid also. In the plica semilunaris, the conjunctiva presented many follicles and large granulations. The scleral conjunctiva was more injected in its upper half than in the lower.

The cornea was covered with a thick, rough membrane rich in blood vessels, with fine ramifications throughout. Toward the upper limbus it was thicker and had taken on a granular aspect. Biomicroscopically, many follicles were seen. The membrane was so dense that it permitted observation of neither iris nor fundus.

Vision was perception of light.

The left eye. The condition of the conjunctiva was similar to that in the right eye; the cornea likewise was covered with a granular membrane which appeared to be thinner in the central portion. The iris could not be seen distinctly; illumination of the fundus was not successful. Vision

was equal to counting fingers at 20 cm.

Operation. The pannus of both eyes was excised with its adherent conjunctiva. Skin from the lower lid was transplanted to the right eye; mucous membrane from

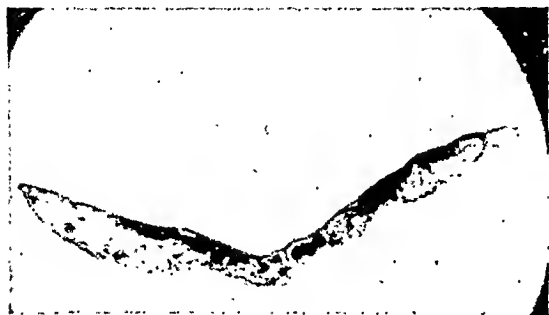


Fig. 1 (Pascheff). Pannus follicularis of the right eye (low power).

the mouth to the left eye (Denig's method).

The patient left the Clinic two months later with vision sufficing only to count fingers at 20 cm. with the right eye; 6/50 with the left.

On October 9, 1939, the patient returned to the Clinic with vision in the right eye increased to 6/50; in the left eye, diminished to light perception.

Upon examining the left eye it was found that the transplanted mucous membrane was red, thick, and showed many follicles on its surface. The secretion was moderate. After some treatment the membrane was removed, and skin from the lower lid was transplanted. The patient left the Clinic on November 9th with vision equal to 6/50 with each eye.

This patient has been under constant observation for the last six years. Her vision has improved to R.E. 6/20; L.E. 6/15. The transplanted skin has become white and brilliant; the transparency of the cornea has increased considerably; neither cornea nor conjunctiva has had a recurrence of the condition. The patient is married and has healthy children.

Histology. The three biopsy specimens

were fixed in formalin, hardened in alcohol, and embedded in paraffin. The sections were variously stained: with hematoxylin and eosin, Van Gieson, Giemsa, also with other stains.

Histologic examination of the thickened portion of the biopsy specimens gave the following results: (1) pannus of the cornea of the right eye. Under low power (fig. 1) the formation of numerous grains of different size and form were seen scattered under the epithelium, which, in some places, was well preserved, in others infiltrated and even destroyed. The grains had pale centers surrounded partly by a more deeply stained cellular zone at the periphery. Between the grains the tissue was infiltrated to a greater or less degree.

Under high power (fig. 2) the grains appeared to be lymphatic follicles with germinating centers having a more or less distinct peripheral lymphocellular zone.

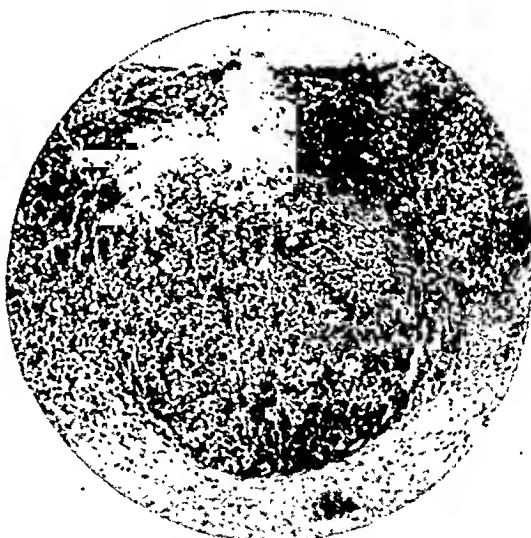


Fig. 2 (Pascheff). Pannus follicularis of the right eye. A follicle of the same pannus under higher power.

The cellular infiltration between these follicles consisted of many lymphocytes and plasmocytes. In the germinating centers were seen actively proliferating lymphocytes, histiocytes, endothelial cells, and many macrophages or phagocytes of

Villard. The latter were especially observable near blood vessels whose capillaries penetrated even into the germinating centers of the follicles. The latter were in different states of evolution but were for the most part individual.

(2) The pannus of the left eye (fig. 3) under low power showed the same grains in the densest part but these were of different lengths. They became fewer in number but longer. The epithelium was infiltrated in some places and had been destroyed in others. Between the follicles the tissue was moderately infiltrated. The grains had pale centers and more darkly stained peripheral cellular zones. Under higher power (fig. 4) it was seen that histologically they were *follicles with germinating centers*. In some sections the follicles were separated by connective tissue, richly infiltrated; in others, the follicles had coalesced and had formed large granulations—which I have termed *folliculoms*. Clinically the confluent follicles

resembled small sausages. The germinating centers contained the same cellular elements as those described for the right eye.

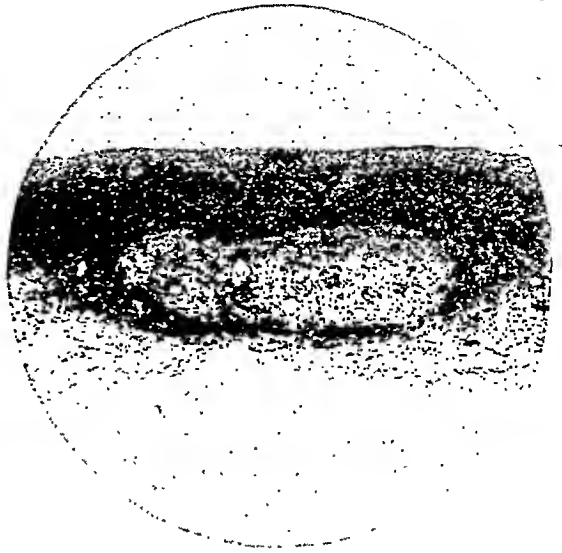


Fig. 4 (Pascheff). Pannus follicularis of the left eye. Follicles in a state of confluence (higher power).

and a transplant of mucous membrane had been made.³

DISCUSSION

This case presents the best proof available up to this time of the existence of follicular pannus. In this instance it occurred bilaterally. The follicles were observed as individual germinating centers and in coalescence. Their histologic structure and development were similar to those observed in true trachoma of the conjunctiva, although this development was independent of the rest of the conjunctiva. In fact, I have observed many cases of follicular pannus developing on the cornea when the remaining trachomatous conjunctiva had advanced to the stage of cicatrization. This individual role of the corneal limbus in chronic hyperplasia of the conjunctiva is still more strikingly apparent in vernal conjunctivitis.⁴

Follicular pannus makes it first appearance between the epithelium of the cornea and Bowman's membrane. Later it

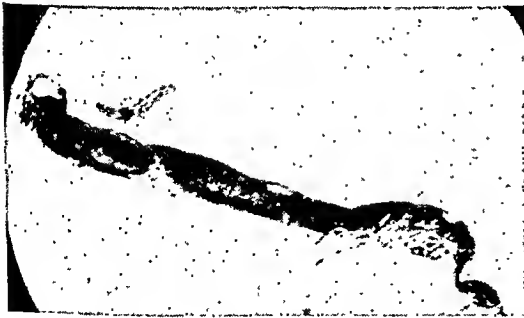


Fig. 3 (Pascheff). Pannus follicularis of the left eye (low power).

resembled small sausages. The germinating centers contained the same cellular elements as those described for the right eye.

(3) The follicular mucous membrane of the transplant showed the following histologic structure: The whole membrane was richly infiltrated with numerous follicles with germinating centers as afore described. I have seen such a recur-

invades and destroys the latter. If follicular pannus is removed surgically, vision returns unless there is a recurrence. To avert the latter, skin must be transplanted to the eye instead of oral mucous membrane.

As to the nature of follicular pannus, it has been shown to have a lymphoid, reticulo-endothelial structure, rich in germinating centers which, in their further development, coalesce, degenerate, and cicatrize, as in true trachoma.

In this respect, follicular pannus of true trachoma is entirely different from the fibropapillary pannus⁵ of vernal conjunctivitis and pannus lymphaticus⁶ of phlyctenular conjunctivitis. In its further stage of development it has been erroneously considered by some writers to be a granuloma of the cornea. As I have demonstrated, the latter has a different structure histologically.⁷

Finally, follicular pannus is histologically entirely different also from the granular form of lupus—keratoconjunctivitis granulosa luposa⁸—in which the whole conjunctiva of the sclera and cornea takes on a granular appearance such as is seen in conjunctivitis miliaris follicularis,³

but with these differences, it has no lymphatic follicles and the granular pannus of lupus is directly continuous with the granular conjunctiva.

In this last respect follicular pannus resembles closely the fibropapillary pannus of vernal conjunctivitis, for both begin at the limbus and generally are quite independent of the state of the scleral conjunctiva.

CONCLUSION

1. Follicular pannus is a lymphofollicular hyperplastic manifestation or reaction of the limbal corneal conjunctiva, and has the same histologic structure and evolution found in trachoma verum. 2. True trachoma, therefore, is not an exudative inflammation of the conjunctiva but a chronic lymphofollicular hyperplasia of the conjunctiva. 3. Although differing in structure, pannus follicularis calls to mind the fibropapillary reaction of the conjunctiva—pannus fibropapillaris—which today is considered an allergic reaction. 4. The best way to avoid recurrence is to transplant skin from the lid instead of mucous membrane.

Rakowsky Str., Asparuch 48.

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THE PLACE OF PERIPHERAL FUSION IN ORTHOPTICS*

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The division of fusion into three degrees, suggested by Worth, is generally accepted in orthoptic circles. This division may be convenient from a practical point of view, but if it is routinely and mechanically applied, it leads to blurring and oversimplification of a complex process. There is an important distinction which is not explicitly made in this division; namely, the distinction between sensory and motor fusion. To understand this distinction and the place which I believe peripheral fusional stimulation to hold in orthoptics, a word on fusion in general is necessary.

SENSORY AND MOTOR FUSION

Sensory fusion means the act of uniting into a single mental image the impressions reaching certain areas of the two retinas. Such unification takes place, in normal individuals, when corresponding retinal points or elements are stimulated. Around each corresponding retinal element, however, there is an area which, although not strictly corresponding or even frankly disparate, also permits unification of biretinal stimulations into single mental images. These areas are known as the areas of single vision of Panum. If there is within these areas a horizontal disparity between the images of the right retina and the left retina, the resulting fused image has the quality of stereopsis.

Generally speaking, then, in order to produce a single image, biretinal stimulations must fall on corresponding retinal elements or at least within Panum's areas. If they fall outside of these areas,

fusion does not occur, but diplopia results.

Motor fusion. The human organism has a pronounced aversion to diplopia—a diplopia-phobia, to use the term coined by Van der Hoeve. In order to establish single binocular vision, disparately imaged objects are brought within Panum's areas and on corresponding points by disjunctive horizontal, vertical, or torsional movements of the eyes. These movements of adjustment are the vergences or fusional movements. They represent what is called motor fusion.

The sensory unification of biretinal stimulations must be distinguished from the reflex movements which occur, when necessary, to make this unification possible. A patient's ability to perform one of these functions does not necessarily imply the presence of the other.

The sensory stimulus for the fusional movements is the disparity of the retinal images. It is as though each pair of corresponding retinal elements was the center of a field of attraction. If similar images occur at different points in this field of attraction, a relative movement of the eyes is produced which ceases when the two images overlap. The farther away from the center the image is located, the weaker is the attraction. Beyond certain limits, marked by the range of the fusional movements, the attraction ceases altogether. If the movement has taken place, then sensory fusion follows motor fusion. This is what happens under normal conditions, with people who have all three degrees of fusion.

DEGREES OF FUSION

The first degree is known as "simultaneous macular perception." A patient is

* Read before the meeting of the American Association of Orthoptic Technicians at Chicago, October 14, 1946.

said to have the first degree of fusion, if he perceives simultaneously and superimposes two nonidentical pictures presented simultaneously to the macular areas. This, evidently, is purely an act of sensory fusion.

It is supposed to be the simplest form or lowest degree of the fusion faculty, the necessary prerequisite for the second and third degrees.

Now, actually, this is by no means as simple as it sounds. To be sure, normal individuals can as a rule easily superimpose these "first-degree pictures," although they often do it more easily with pictures containing fusional stimuli. However, patients with concomitant strabismus often have great difficulties in this. They try, above all, to avoid bimacular stimulation. They will suppress, they will change the angle of squint, they will change the mode of sensory localization—all in an effort to avoid bimacular stimulation. Although they may apparently not even have the first degree of fusion, one can, nevertheless, show that some of them have a rather well-developed fusion faculty. I have seen in many instances that if the stimulation of the macular areas is avoided, such patients not only have good sensory fusion, but they even exhibit fusional movements in response to disparate stimulations. Simultaneous macular perception, then, is not necessarily the "first degree" of fusion in patients with strabismus.

Worth's second degree of fusion is present when the patient can fuse dissimilar pictures and has some degree of fusional amplitudes. This second degree is concerned both with sensory and with motor fusion. It may be present, as I have just pointed out, in patients who do not display the first degree, if there is a special distribution of the stimulus pattern. The second degree is of particular interest in the discussion of fusional

movements produced by disparate stimulation of more peripheral retinal areas.

The third degree, finally, is achieved when the patient has stereopsis. Depth perception is a sensation *sui generis* which is ordinarily based on the fusion of disparate retinal images. It has some independence from fusion, both sensory and motor, for it can occur in diplopia. Since, in my opinion, it is a fundamental sensation, it cannot be taught. It is as little a matter of experience and as little teachable as the sensation of red or green. What can be taught, is the refinement of stereopsis. Once a patient does have stereopsis, he can be trained, within limits, to discriminate ever finer differences in retinal disparities and to perceive them as depth differences.

A close analysis does not leave much to say on behalf of Worth's three degrees of fusion. The first degree is not as fundamental as appears at first glance. It may be absent in patients in whom the second degree may be shown to be present. The third degree, stereopsis, is really not the highest degree of fusion but rather a sensation *sui generis*. To be sure, it ordinarily presupposes sensory fusion as well as the presence of fusional amplitudes, but the latter in particular are accessories not essential to the sensation. Strictly speaking, therefore, stereopsis is not the highest degree of fusion.

PERIPHERAL RETINAL STIMULI

Some of the deductions which I have just presented to you are the result of studies which I undertook several years ago to investigate the part played by more peripheral areas of the retinas in the act of motor fusion.^{1, 2} These investigations were carried out by means of an instrumentation which was briefly as follows.

TECHNIQUE

The patient is seated at 15 feet from

an aluminized projection screen, with his head fixed in a headrest. Behind him are two projection lanterns placed on an adjustable stand. The beams of these lanterns are projected on the screen by adjustable mirrors. The mirrors, as well as the lanterns, pivot around a vertical axis; the projectors can be raised and lowered. Thus, they form a haploscopic arrangement, and targets projected by them can be placed independently on any desired region of the screen.

To dissociate the eyes, polaroid material is used. By placing the plane of polarization vertically in front of one eye and horizontally in front of the other eye, and by attaching corresponding sheets of polaroid material at the end of the tubes of the projection lanterns, a pretty good extinction is obtained. As a result, the targets projected by one lantern are seen only with one eye; the targets projected by the other lantern with the other eye. A third projector is used for auxiliary purposes. It, too, may be provided with polaroid. If it is desired to project a binocularly seen object, the polaroid is removed from that projector.

In order to have a check on the position of the eyes, two small movable projectors are placed one on each side of the patient. Each of these projectors also has a polaroid filter. As a rule, a short red and a short green line, each seen by one eye, are projected by these lanterns. One line is placed so that it corresponds to the fovea of the fixating eye; the position of the other line is adjusted by the patient. He keeps the two test lines always on a level or above each other by means of a handle on the projector. The position of the lines on the screen indicates directly the position of the eyes in patients with concomitant strabismus and normal correspondence. In anomalous correspondence, the position of the test lines tells the angle of anomaly.

This projection arrangement is extremely flexible. In normal individuals, it can be used to examine fusional amplitudes by stimulating any desired retinal area. Stereopsis at distance can be measured if stereoscopic slides are used in the haploscopic target projectors.

In patients with strabismus, one can measure within the limits of the screen the objective and subjective angles, if a tangent scale is projected by the auxiliary lamp. Sensory fusion in any area can be tested. Fusional amplitudes can be determined by stimulating or excluding from stimulation any desired area.

PRELIMINARY INVESTIGATIONS

In applying this instrumentation in preliminary investigations to normal individuals,¹ I found, as was to be expected, that fusional movements can be produced by disparate identical stimulations applied to the retinal periphery. I could, for example, produce typical fusional movements by presenting identical squares to the peripheries of the retinas of the dissociated eyes. These squares were at first superimposed on the screen and then slowly moved up and down, relative to each other, until the disparity of the retinal images became so large that they no longer produced an impulse to fusion. Although the observer usually saw these squares in the periphery, he was not always aware of the shapes, particularly if the squares were well out in the periphery. Their effect on the position of the eyes was determined by the test lines on which the observer concentrated his attention.

As was also to be expected, to obtain a standard amount of fusional amplitude the size of the stimuli had to be larger the farther away from the macula they were placed.

It was most interesting, however, to find that with targets of appropriate size

it was possible to achieve such powerful peripheral fusional stimuli that central fusion could be broken up. That is, if an observer fixated binocularly and fused a centrally seen object, it was possible to break the central fusion by strong peripheral fusional stimuli, and the binocularly seen object would appear double no matter how hard the observer tried to maintain central fusion.

STRABISMUS PATIENTS STUDIED

The examination of patients with concomitant strabismus yielded many very interesting results with regard to the visual act in strabismus.² I can mention here only those which I believe to have a direct bearing on orthoptic practice.

The patients studied had a convergent or divergent strabismus with every type of sensory reaction. The only thing which they all had in common was that the angle of squint did not exceed 12 degrees because of the physical limitations of the screen. This was no handicap, since patients with a relatively small angle of squint are the ones who are most important from the orthoptist's point of view. As a rule, larger angles have to be reduced by surgery before the patient is submitted to visual training. All patients were thoroughly tested not only with the routine methods, but also with the various tests which the projection arrangement offered.

Now, I was able to show beyond any doubt that some of these patients were able to perform fusional movements when tested in an appropriate way with the projection instrument, although there was no trace of fusional movements when the patients were examined with the routine methods. This was a significant finding, since all the best authorities had heretofore absolutely denied the existence of fusional movements in the presence of a manifest strabismus. It was

even more interesting to learn under what condition these fusional movements would come about.

I soon found in the tests preliminary to the application of disparate stimulations that two modes of response to central (macular or foveal) stimulations could be distinguished, irrespective of the state of retinal correspondence. The patients were either able to superimpose macular stimulations or they were not. For instance, if I projected a Maddox cross seen by one eye, and a movable red dot seen by the other eye, and asked the patient to move the red dot so that it would subjectively cover the zero of the scale, certain patients would place the dot without hesitation on a point on the screen corresponding to their (normal or anomalous) subjective angle and would state that the dot was now on zero. Other patients were quite unable to do this. They would move the dot until it approached the area on the screen corresponding to the visual line of the deviated eye (or the zero of the scale in anomalous correspondence). Then, suddenly, they would find that either that area of the scale or the dot had disappeared (suppression); or else the dot would suddenly jump to the other side of the scale because of a change in the sensory relation of the retinas (from anomalous to normal correspondence or *vice versa*); or, finally, the zero of the scale would keep creeping away when the dot approached, or make a slight shift to the other side of the dot, owing to changes in the angle of squint. All of these patients were unable to superimpose subjectively the dot and the zero of the scale in spite of patiently repeated attempts.

RESULTS

In this way, I could differentiate patients who presented a central sensory disturbance from those who showed no

such disturbance. It proved that these patients also behaved differently with respect to peripherally applied fusional stimulations.

Those who had no sensory disturbance did not follow peripheral fusional stimulations. When the targets were displaced vertically, either at the angle of squint or at the angle of anomaly (if the correspondence was anomalous), their eyes did not follow the disparate stimulation. They either saw the displaced targets double or, more frequently, suppressed one retinal periphery.

Those, however, who had a central sensory disturbance in the majority of the cases did follow peripheral disparate stimulations in a typical way and under one condition only—stimulation of the retinal centers had to be avoided.

The patients, with central sensory disturbance, who did not follow peripheral fusional stimulations were generally those who totally suppressed all stimulations reaching one retina; in other words, those who had complete monocular vision, as for instance in alternating divergent strabismus.

ORTHOPTIC USE OF PERIPHERAL RETINA

These results seem to me to be of considerable interest for those concerned with visual reëducation.

I believe that it is important for the orthoptist to know that peripheral fusional stimuli are very strong and capable of dominating the fusional impulses from the macular areas. By concentrating almost exclusively on central retinal areas in training binocular vision and fusional amplitudes, a powerful tool is being neglected. I am sure that in all cases favorable results could be obtained much more rapidly if use were made of the large areas of peripheral retina which are so highly responsive to disparate stimulation.

On the other hand, it is certainly significant that it is possible to diagnose, as it were, the seat of the sensory disturbance in a patient. It is not sufficient to say that a patient has or has not "first degree of fusion." The sensory behavior of the retinal periphery must also be investigated. If it is found that the patient has a marked aversion toward simultaneous stimulation of the macular areas but that he fuses with peripheral areas when the center is excluded, it would seem that the long battle between the orthoptist and the patient to establish his first degree of fusion could be won more easily and quickly by the orthoptist if she did not insist on the frontal attack on the macular areas of the patient. She should first concern herself with the peripheral areas which would more readily yield to her ministrations and should then infiltrate from there the macular areas. This should be the most effective way to overcome the sensory disturbance of the central retinal regions.

Finally, I should like to point out that there is one condition in which only peripheral retinal stimulations can be effective. This is cyclophoria. I have no personal experience with the training of cyclofusional amplitudes and do not know whether or not they can be trained. However, I do not see any theoretical reason why this should not be possible. If it is possible, it could only be achieved by stimuli placed at some distance from the retinal center. If you think of the eye as a wheel and of the visual line as a rod, the end of which is put through the center of that wheel, you will readily see how much easier it would be to turn the wheel by one of the spokes than by the rod.

CONCLUSION

If I should conclude by saying that, for all the reasons brought forth, the orthoptist should always study the sen-

sory behavior of the peripheral as well as the central areas and make use of the training potentialities of the retinal peripheries, this question is in order—what should be done about the practical application of fusional stimulations?

Unfortunately, I am not prepared to answer this question at this time. I cannot report any experiences in actual orthoptic training along the lines suggested. Conditions during the past years made it impossible to develop a method or to apply it in practice. I think that the ordinary major amblyoscopes do not offer a sufficiently large field of vision and are not flexible enough. I see no reason, however, why a simplified projection arrangement could not be developed to be used for orthoptic training of all types of disturbances.

I have found, for instance, accidentally and without looking for it, that what is known to the orthoptist as "massage" of the macula can be achieved with the projection arrangement herein described, most successfully and with very little physical effort. For this purpose the Maddox tangent scale, seen by the patient with the fixating eye, and a small colored light spot can be used. The light spot can be moved easily and with any desired speed over any area of the screen. If it is moved rapidly in the region of the visual line of the deviated eye, patients whose anomalous correspondence is not too deeply rooted will soon report that the

spot suddenly "jumped" to the other side of the screen; that is, these patients now localize according to normal correspondence.

This is only an example of how the projection arrangement can be applied. Its most important application, however, lies in the possibility of reaching, during the exercises, one retinal area while at the same time excluding others.

It should be mentioned here that even without the use of a projection arrangement, the principle of simultaneous stimulation of peripheral retinal areas can be utilized. Swan and Laughlin³ have reported encouraging results in developing single binocular vision in patients with high amblyopia ex anopsia and absolute central scotoma in the afflicted eye by using large ring targets. A green ring with a central dot for fixation was presented to the normal eye and a red ring with a blank background to the amblyopic eye. The authors state that, with training, many patients lacking sharp central vision fuse the rings and develop a considerable amplitude of fusional movements.

At present, I cannot make more definite practical suggestions, but I hope that I have indicated the important place which peripheral fusional stimulations should take in orthoptic training. I shall be much gratified if I have been able to arouse some interest in this subject.

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DISCUSSION OF DR. BURIAN'S PAPER

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It is difficult to evaluate the full significance of diagnostic material such as Dr. Burian has presented, but we can appreciate the amount of study and research that made this presentation possible. I should like, at this time, to be able to present orthoptic data sufficient in quantity and quality to substantiate Dr. Burian's findings. Lacking the statistics for such a discussion, I shall begin by expressing my admiration and continue by accepting the challenge he has given us as orthoptists.

The idea of peripheral fusional training is not new at our clinic. For the past several years, we have used peripheral-fusion tactics at Iowa in an attempt to improve the chances for single binocular vision in patients with amblyopia. Recognition of the possibilities in this field of orthoptics led us to believe that we could help a number of patients with neglected monocular strabismus and offer them more than a purely cosmetic correction.

Our first observation of peripheral fusional movements was probably prompted by the considerable number of amblyopic patients who were also accommodative. This led to a more careful study of the binocular behavior of amblyopes at the synoptoscope and to the development of our simple peripheral fusion charts.

The targets consist of rings with a diameter subtending a visual angle of about five degrees. A green ring with a central dot for fixation is presented to the normal eye, while a red ring with a blank background is presented to the amblyopic eye. The ring, of course, must subtend a visual angle larger than the scotoma. These targets are used in the synoptoscope, which is adjusted by the corneal

reflex method to correspond to the deviation of the eyes. In cases where normal retinal correspondence can be demonstrated and where the deviation is not too great, the patient is instructed to carry on with similar peripheral fusion targets in the stereoscope at home. Even the small percentage of cases in which favorable results are obtained warrants the continued use of this type of fusion training. I am sorry that not enough has been done to allow a more comprehensive report. It is obvious that perseverance is difficult in these cases for the same reason that characterized their delayed initial examination. In a busy clinic, the time element involved in treating these cases orthoptically is another factor to be considered.

Returning to Dr. Burian's statement concerning the division of fusion, I admit that I have always found it difficult to classify my patients as having first, second, or third-degree fusion. I am grateful that our doctors have not insisted upon such a classification. In our clinic, we use a graphic description of the status of simultaneous perception and vergences, which is supplemented by numerous marginal qualifying notations. This seems to serve our purpose in recording initial and subsequent findings.

INFILTRATION OF MACULAR AREAS

Dr. Burian's suggestion that we infiltrate the macular areas after good peripheral fusion has been established seems logical. A method of reducing the angle of anomaly in anomalous retinal correspondence was described by Miss Walraven at the recent meeting in Boston. Starting beyond the subjective angle with one arm of the major amblyoscope sta-

tionary at zero, the opposite target is brought in repeatedly until suppression takes place, and is then moved back each time until simultaneous perception is recovered. As the targets move through the subjective angle, the patient may become aware of monocular diplopia. This diplopia is used as a tool to obtain eventual fusion at the objective angle. Is this a preliminary step in peripheral training? Miss Walraven accomplishes this with the major amblyoscope. A projection arrangement would, no doubt, have added value, if its manipulation and the gyrations of the child could be controlled as readily as is possible on the major amblyoscope.

A variation of the red-green test, somewhat similar to the projection arrangement described by Dr. Burian, is at present being used in our clinic, purely as a testing device to verify synoptoscope and after-image findings. It has possibilities as a training device when certain mechanical improvements can be made.

By inducing consciousness of the periphery, are we making an initial move toward peripheral fusional training? We use a vertical prism to displace one image to a peripheral area where it is not suppressed, thus giving a patient his first awareness of diplopia. Miss Lancaster's bar-reading technique begins by making the child aware of a double bar at a near point when fixation is on a more distant object. These images of the bar fall upon disparate retinal areas. Gradually the bar is moved toward the fixated object, thereby varying the peripheral areas brought into use. Each time suppression takes place, the process is repeated. Can

this be called infiltration of the macular areas?

As Dr. Burian points out, certain patients show a strong aversion to bimacular stimulation and are unable to superimpose dissimilar pictures (according to Worth's first-degree fusion). They often describe these targets as jumping around or over each other. We use partially identical targets (two pairs of simple 10-mm. colored balls which are fused as three balls). These targets allow for some central suppression and uncover any latent tendency toward peripheral fusion. They provide a starting point for most patients and those capable of single central binocular vision readily go on to more detailed binocular tasks. Dissimilar targets, such as the fish and the bowl, are used for testing the status of retinal correspondence in very young children at the synoptoscope.

I share Dr. Burian's opinion that stereopsis cannot be taught. Our experience seems to indicate that even in phoria cases, unless the loss of depth perception is associated with a small degree of suppression, no improvement in stereopsis follows orthoptic treatment. When suppression is present, stereopsis appears simultaneously as suppression is overcome.

Dr. Burian's extensive study of sensorial retinal relationships has made it possible for us to evaluate better the binocular behavior we encounter from day to day. I am sure he has succeeded in arousing an interest in peripheral fusional stimulations which will be manifested in future orthoptic procedures.

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NOTES, CASES, INSTRUMENTS

WETTING AGENT FOR CONTACT LENSES

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Although the present day plastic contact lenses are a great improvement over both the Müller and the Zeiss glass contact lenses, there still are many problems that vex the ophthalmologist who prescribes and fits contact lenses. The most frequent complaint is fogging. The following are some of the more common causes for the fogging of vision experienced by the wearer of contact lenses: (1) Improper refractive correction. (2) Dirty contact lenses. (3) Cloudy solution. (4) Corneal edema. (5) Spasm of accommodation. (6) Clouding of the solution after insertion of lenses. (7) Meibomian-gland secretions on the anterior surface of the contact lenses. The first three causes for fogging can be eliminated by the ophthalmologist and the patient and will not be discussed here.

Corneal edema usually comes on from 30 minutes to four or more hours after the insertion of the contact lenses. It is due to the imbibition of the buffer solution by the corneal epithelium. The continued daily wearing of the contact lenses seems to toughen the corneal epithelium so that as time passes the patient can wear the contact lenses for longer and longer periods of time before fogging due to corneal edema begins. In some cases changing the strength or the formula of the buffer solutions will lengthen the time before fogging occurs.

Contact lenses, although well fitted, like any other foreign body in the conjunctival sac, induce stimuli which in turn produce undesirable reactions. Among these undesirable reactions is the spasm of accommodation noted in many cases, especially in the hyperopic patient when he first

begins wearing contact lenses. This spasm of accommodation relaxes after a longer or shorter period of time as the eye becomes accustomed to the lenses.

In the same manner the contact lens acting as a foreign body stimulates the various paraocular glands. This at first thought would seem unimportant, but if we recall that the goblet cells are most numerous in the bulbar conjunctiva and that the scleral part of the contact lens acts as a funnel placed over the bulbar conjunctiva thus catching the mucous secreted by these glands, we can readily see how the stimulation of the goblet cells will cause the buffer solution to become cloudy due to the increased quantity of mucous. This, like the spasm of accommodation, decreases in most cases as the eye becomes accustomed to the presence of the contact lens.

The greasy secretion of the meibomian glands, essential as it is in preventing the tears from spilling over onto the cheeks, and in sealing the eyelids during sleep, often proves to be the greatest problem with which the contact-lens wearer has to contend. In the first place the manipulation of the eyelids during the process of inserting the contact lenses, massages the secretion from these glands; then the contact lenses by their presence in the conjunctival sac reflexly stimulate the meibomian glands, as well as the other paraocular glands, and an excessive amount of this special sebum is produced. This increased sebum on the lid margins would be of no consequence if the anterior surface of the contact lens were wet so that it would repel the greasy meibomian-gland secretion. However, since the tears are a poor wetting agent, they do not wet the plastic contact lens. Thus, the meibomian-gland secretion is smeared onto the anterior surface of the contact lens producing a fogging of vision which is

very annoying to the contact-lens wearer.

In an effort to overcome this difficulty, patients have been instructed to place their contact lenses into one of a number of wetting agents with the hope that when the lenses are inserted the tears will wet them and prevent the smearing of meibomian-gland secretion over the anterior surface of the lenses. As wetting agents, these solutions have been very satisfactory. However, these solutions are irritating to the conjunctiva, and patients are instructed to rinse the contact lenses well with water after removing them from the wetting agent and before inserting them. By this procedure most, if not all, of the beneficial effect of the wetting agent is lost, and the patients continue to have fogging of vision due to sebum smeared over the anterior surface of the lenses.

A search has been made to find a wetting agent which would be tolerated by the conjunctiva so that some of the wetting agent might be left in contact with the lenses thus keeping the anterior surface of the contact lenses from becoming dry. To my knowledge, at the time of this writing, paratertiary-octyl-phenoxyethoxy-ethyl-dimethyl-benzyl ammonium chloride monohydrate (1:5,000) in a 2-percent boric-acid solution* is the only wetting agent that can be used without danger of producing an irritation.

The patient is instructed that when the contact lenses are removed, they are to be placed in a small, covered jar containing an ounce or so of wetting agent. The lenses should remain in this solution until the patient is ready to reinsert them. When the lenses are taken from the jar, the excess solution should be removed by a quick shake—not by rinsing. The contact lenses are inserted in the usual manner and, after the contact lenses are in place, the eyes are washed with an eyecup

filled with the wetting agent. This procedure utilizes the detergent action of the wetting agent to wash away the excess meibomian gland secretion in addition to leaving a film of wetting agent over the anterior surface of the contact lenses. This helps to keep the lenses from becoming dry and repels any remaining sebum from the anterior lens surface.

441 Lowry Medical Arts Building (2).

REFRACTION CLINIC*

DISCUSSION BY

ALBERT E. SLOANE, M.D.†

Boston

A man, aged 39 years, noted three weeks earlier that he saw double unless he kept his head tipped and avoided looking to the left. He had never worn glasses before, and was not greatly inconvenienced by his present difficulties. Examination revealed vision to be: O.D., +1.00D. sph. \ominus -0.50D. cyl. ax. 90°, 20/20; O.S., +1.00D. sph. \ominus -0.50D. cyl. ax. 90°, 20/20.

Distance phoria test revealed: Distance —4^A exophoria; phoria—8^A right hyperphoria (O.D.), in the primary position.

Diagnosis was paresis of the left superior rectus muscle.

DISCUSSION

The symptoms of which this patient complained could be definitely attributed to a paresis of the left superior rectus muscle. This was substantiated clinically by his tendency to keep his head cocked back and to the left so that his eyes were directed for the most part down and to the right. The red-glass diplopia field gives us some very valuable information from a therapeutic standpoint. You will

*This preparation is a Parke, Davis and Company product sold under the name of Phenrol Ophthalmic.

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† Director of Department of Refraction.

note that there is quite a bit of exophoria manifested in the three upward positions of gaze. This is due to an anatomic divergence produced by the axis of the orbits when the eyes are in elevation. This is not due to any muscle weakness, because if a horizontal muscle were defective the horizontal imbalance would be greatest in one of the horizontal planes. When we consider the indications for prismatic correction, the diplopia field immediately tells us how much can be accepted without disturbance. The principal positions of gaze ordinarily used by a patient are the horizontal and the lower fields, and in these areas the minimum hyperphoria is 3 arc degrees, or approximately 6 prism diopters (1 arc degree equals 2 prism diopters approximately). Therefore, a prismatic correction up to 6 prism diopters will not introduce an opposite hypertropia. You will note that in the upper right position of gaze the vertical diplopia is smaller, 2 arc degrees or 4 prism diopters, but since one can easily avoid utilizing this field, it may be omitted from our consideration.

SOLUTION

Disturbing diplopias can be relieved by several measures: 1. Occlusion of one

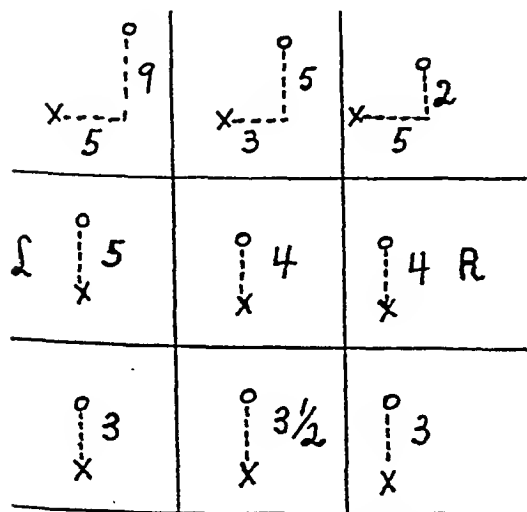


Fig. 1 (Sloane). Red-glass diplopia field plotted in arc degrees, x = O.D.; o = O.S.

eye. 2. Prismatic lenses. 3. Surgery.

In this instance, since the diplopia has never really been disturbing because the patient learned how to tip his head to minimize the difficulty, occlusion of one eye is not necessary. Glasses were prescribed for constant wear, which included: O.D., 2 prism diopters, base down; O.S., 2 prism diopters, base up. That is, 4 prism diopters of right hyperphoria correction were prescribed. He was told that he would still have to tip his head to neutralize the diplopia somewhat, since a partial correction only was given. It is best to prescribe, as a general rule, the smallest amount of prism that will obviate symptomatology. This has the further advantage of lasting the patient a longer time in a more suitable fashion as the paresis tends to diminish in amount. The patient was then referred for a complete medical and neurologic check-up, and all the findings were subsequently reported as negative. Glasses were prescribed as follows: O.D., +1.00D. sph. \ominus -0.50D. cyl. ax. 90° , with a 2^Δ base down; O.S., +1.00D. sph. \ominus -0.50D. cyl. ax. 90° , with a 2^Δ base up.

The patient reported back six months later at which time the diplopia field had not changed appreciably. The distance phoria readings in the primary position of gaze were as found at the first examination. The patient has been without symptoms and without diplopia and cannot get along without his glasses. He still can produce diplopia easily by looking to the left and up, but has developed a mannerism of keeping his head cocked in a compensatory way so that he never sees double, unless he looks for it.

QUESTIONS

House Officer: Once prisms are prescribed for a patient, does he always have to wear them?

Dr. Sloane: If the paresis clears up,

prisms will be rejected by the patient.

House Officer: Can you obtain this amount of prismatic effect by decentering the lenses?

Dr. Sloane: Displacement of 1 mm. in a 1-diopter lens will give 1/10 of a prism diopter prismatic effect, so obviously one cannot obtain sizable prismatic effects in weak lenses. In this case prisms were ground into the prescription.

House Officer: How can you tell the presence of a prism in a spectacle lens?

Dr. Sloane: There are three methods:

1. A difference in thickness of opposite edges of a lens would make you suspect a prism, but this would only hold true if the prisms were fairly strong.
2. The lensometer readings will be displaced from the center even though the lens is set in the instrument with its geometric center properly placed.
3. If you view a straight line through the geometric center and along the principal meridian of the lens, the line will not be continuous within and outside the lens, but will be displaced according to the power of the prism.

House Officer: If this man were presbyopic, how would you manage his glasses in bifocals?

Dr. Sloane: As a rule, any person who has to tip his head back over one shoulder cannot get along well with bifocals because he will look through different portions of each segment. Therefore it is advisable in such cases to avoid their use and to insist upon single vision glasses.

House Officer: Is it advisable to divide the prisms between both eyes or to incorporate them before one eye alone?

Dr. Sloane: Prisms ground into lenses make their cost greater, therefore, when it is possible we should correct the defect with prisms before one eye, but this

is only effective if the total amount of prism power is not in excess of approximately $1\frac{1}{2}$ prism diopters. The advantages of dividing prisms between two eyes are: (1) Both lenses weigh approximately the same so there is no tendency for the lens to hang lower on one side. (2) The spectacles are less conspicuous. (3) There is less chromatic aberration and other distortions which occur when one looks through strong prisms.

House Officer: When do you operate for the relief of diplopia in a paresis?

Dr. Sloane: There are two criteria. (1) If the amount of prismatic correction, in order to remove symptoms, is over 8 prism diopters, correction prisms are usually not satisfactory. (2) One should wait a certain period of time to allow the muscle to recover, if it is going to, and also to allow for secondary contractures which are likely to be the case, so that one can better judge what type and how much surgery should be done.

House Officer: How long is this time?

Dr. Sloane: Most persons agree that six months is a fair waiting period.

House Officer: In this case, if surgery had to be done, which muscle and what procedure would be indicated?

Dr. Sloane: Probably a weakening operation on the yoked muscle of the opposite eye. In this case a myectomy of the right inferior oblique muscle.

House Officer: What is the rationale for selecting the right inferior oblique?

Dr. Sloane: Hering's law suggests that one must innervate yoked muscles alike. Thus, a weakened right inferior oblique would require greater innervation, as does the paretic left superior oblique, thus tending to equalize their resultant activity and lessen the diplopia. Of course one can, theoretically, also do a strengthening operation to the left superior rectus for the same reason.

243 Charles Street (14).

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 4, 1946

DR. BENJAMIN FRIEDMAN, *president*

CLINICAL ANATOMY OF VISUAL PATHWAYS

DR. MORRIS B. BENDER spoke on this subject during the instructional hour.

NEUROLOGIC LESIONS OF OPTIC PATHWAYS

DR. I. M. TARLOV described two cases of meningioma of the sphenoidal ridge. The first case was of a man who had been operated two years previously, and the second was of a woman who was operated four years previously. Proptosis was present in both cases and X-ray studies showed absorption of the sphenoidal ridge. Although both cases showed excellent results following operation, there was very little, if any, recession of the proptosis, which was marked in one case and slight in the other. The intraorbital, as well as the intracranial portions of the tumor, were removed in both cases.

Dr. Tarlov also presented a case of orbito-ethmoidal osteoma, which was operated. The sudden development of an intracranial, frontal pneumatocele in this patient was associated with a contralateral hemiplegia. This disappeared completely after removal of the osteoma, evacuation of the air within the frontal lobe, and repair of the dural defect in the floor of the anterior fossa with fascia lata graft. Other orbital tumors were discussed and an X-ray picture of a calcified orbital meningioma was shown. Dr. Tarlov concluded by pointing out the advantages of the trans-frontal approach for orbital tumors, many of which have intracranial extensions.

Discussion. Dr. Alfred Kestenbaum stated that there are three types of meningioma which are of importance to the ophthalmologist:

1. Meningioma of the olfactory groove. This is the most frequent but not the only cause of the Foster-Kennedy syndrome.

2. Suprasellar meningioma. Suprasellar tumors may result in bitemporal hemianopia which sometimes starts as a bitemporal hemianopia central scotoma. The nasal half of the macular area of the field is always preserved.

3. Meningioma of the sphenoid ridge. This condition may show an ophthalmic syndrome, which if fully developed consists of the following signs: (a) Symmetrical exophthalmos—exophthalmos without lateral or vertical displacement of the eye, as is often seen in orbital tumors close to the eye. (b) Negative resistance-sign—the eye can be pressed backward as normal; whereas, in tumors immediately behind the eye, a hard resistance is felt. (c) Eye-muscle palsies—may be due to either a lesion of the nerves or to a direct pressure on the muscles. (d) Retrobulbar lesion of the optic nerve caused by pressure—may produce a central scotoma and temporal pallor, and later total blindness and total “descending optic atrophy” of the disc. (e) Disturbances of the pupillary reactions—depending upon the damage to the optic nerve.

Aneurysms of the brain arteries have become of great importance to the ophthalmologist in recent years. The following types are of special interest:

1. Arteriovenous aneurysm of the carotid artery in the cavernous sinus. This causes the well-known picture of pulsating exophthalmos.

2. Simple aneurysm of the carotid artery in the cavernous sinus without arteriovenous communication. It may be the cause of eye-muscle paresis but there is neither exophthalmos nor pressure on the orbital part of the optic nerve.

3. Aneurysm of the carotid artery after it passes through the dura and arachnoid within the subarachnoid space. In this case the visual field changes may become manifest in two forms because the carotid lies laterally to the chiasm: (a) Pressure on the chiasm from the side may result in a nasal defect in the field of one eye (not a binasal defect). (b) Pressure of a big aneurysm of the right carotid artery upon the right optic nerve, as well as upon the right optic tract, may result in a combination of left-sided hemianopia and loss of the macular vision in the right eye.

4. Aneurysm of one of the anterior arteries of the circle of Willis. The anterior cerebral and anterior communicating arteries may cause pressure on the chiasm from in front and above and at the same time on one optic nerve. In this case the visual field will show bitemporal hemianopia and loss of the macular area of the eye homolateral to the aneurysm.

5. Aneurysm of the posterior part of the circle of Willis (as of a posterior communication or of a posterior cerebral artery) often affects the oculomotor nerve. In recent years it was emphasized that isolated palsy of the oculomotor without any other signs should arouse the suspicion of such an aneurysm.

FIELD CHANGES IN PITUITARY SYNDROMES

DR. DANIEL KRAVITZ stated that to the average ophthalmologist, field changes in the pituitary region means bitemporal field defects. However, in no other part of the brain are the field changes so varied and so difficult to interpret. It is only in this region that one can get blindness in one eye or both, binasal or bitemporal defects,

homonymous hemianopias, central scotomas, and all manners of combinations of these. For a proper understanding and interpretation of these variations, Dr. Kravitz stressed the need for a knowledge of the anatomy, embryology, and physiology of this region.

Dr. Kravitz concluded that to wait for the typical field changes before making a diagnosis would frequently end in tragedy. Therefore, some knowledge of the anatomy and physiology of those parts of the brain which may affect visual pathways is essential.

Discussion. Dr. Thomas H. Johnson opened the discussion by saying that the variation in the visual fields is due to the relation of the chiasm to the surrounding structure. Walker and Cushing found in a series of 183 cases of pituitary tumor that 148 cases showed field disturbance. Bitemporal hemianopia was present in 47 cases, homonymous in 22 cases; 79 patients were blind in one eye, and the type of hemianopia could not be determined. De Schweinitz found homonymous field defects in 6 percent of his cases, and Hirsch in 7 percent. The tumors may not grow symmetrically, but may encroach more upon the structures of one side than the other. In a study by Schaeffer, it was found that the chiasm may lie in front of, directly over, or behind the pituitary.

In about three fourths of the specimens, the anterior and often the greater part of the chiasm rests on the sella diaphragm. At times there may be a vertical space of 10 mm. between the pituitary and the chiasm. It is obvious that neoplasms, having their origin in tissues beneath the chiasm, give early defects in the upper temporal quadrants; while those arising from tissues above the chiasm show defects in the lower temporal quadrants.

Before any of the changes produced by pressure manifest themselves, however, scotomas may be present. The most com-

mon location of the scotomas is in the cecocentral area, not uncommonly in the lower temporal quadrants but rarely in the nasal half of the field. They are prone to be bilateral. These scotomas progressively widen into quadrant defects and hemianopias.

De Schweinitz supports the theory of Fuchs, that they are caused by toxins, thrown off from the neoplastic tissues into the cerebrospinal fluid in the cisterna chiasmatica, which bring about a retrobulbar neuritis.

Walker and Cushing think scotomas of this character can not be explained on a mechanical basis alone, and that an explanation based on hypersensitiveness of the papulomacular bundle, or toxic actions, is unsatisfactory but must be accepted in the light of our present knowledge. They believe that pressure upon the chiasm from the tumor alone does not account for all of the field changes, but that traction and tension upon the crossed fibers, and counterpressure from the anterior clinoid processes, dural bands, and the bony walls of the optic foramen, are important factors, as well as pressure on the tracts farther back against the peduncles. They report, on the other hand, a case in which pressure by the neoplasm had greatly displaced one of the optic tracts, without producing any change in the visual fields or optic discs.

Fay and Grant reported a case of pituitary tumor which pressed the chiasm against the anterior cerebral artery, causing the artery to indent the optic tract and thus produce an homonymous hemianopia.

Traquair's hypothesis is that field defects in chiasmal lesions are due to pressure, traction, and the action of toxins; that the pressure does not produce the changes by direct action upon the chiasm but by impeding venous return and producing arterial ischemia. He thinks the

scotomas indicate activity of tumor growth.

It is a common belief that the maculopapular bundle is very susceptible to the effects of toxins, and the toxin theory regarding production of scotomas is probably acceptable to most ophthalmologists. A bilateral scotoma in the visual fields, a scotoma in one field and slight upper or lower temporal defect in the other, or a slight bilateral upper or lower temporal defect should put one on guard against a lesion of the chiasm.

As the optic atrophy is a descending one, the disc may not become pale until the hemianopia has been in existence for some time. As a rule the nerve head is a pink, waxy color. The disc outline is more often than not blurred by a deposit of connective tissue; as is the lamina cribosa.

Internal hydrocephalus may distend the third ventricle to such a degree as to press upon the chiasm, erode the bony structure around the sella, and bring about a hemianopia. Dr. Johnson said that he had had such a case in a 9-year-old boy. These cases, he said, showed a papilledema rather than a pale optic-nerve head. He also spoke of a case in which an aneurism of the circle of Willis simulated a pituitary neoplasm. All verified recorded cases of such aneurisms have had a paralysis of the third nerve.

Gliomas of the chiasm produce very irregular and early field defects, may show an enlargement of the optic foramen, and may be accompanied by a more or less general neurofibromatosis. Dr. Johnson concluded his discussion by remarking that, since most lesions which produce the chiasmal syndromes erode the clinoid processes or widen and distort the cells, careful X-ray studies by a skilled roentgenologist will clarify the diagnosis.

Dr. Bender said that in the neurologic clinics of Bellevue and Mount Sinai Hospitals, they are not able to make exact

localization as to whether the lesion is above or below. In some cases, autopsy reveals tremendous tumors near the chiasm with no visual-field defects; in others, there is tumor depression of the entire chiasm. Dr. Bender said that it was not possible to determine whether the tumor was anterior, posterior, or lateral.

Dr. Alfred Kestenbaum said that the two terms—bitemporal hemianopic central scotoma and true central scotoma—must be sharply separated from each other.

Because the fibers originating from the nasal halves of the two maculas cross the midline in the most posterior part of the chiasm, involvement of the chiasm from behind, that is by a suprasellar tumor, may cause a bitemporal hemianopic central scotoma. In each field the nasal half of the macular area is damaged; whereas, the temporal half is preserved. In other words, there is "macular splitting." Visual acuity may still be 20/20. Completely different from this picture is the real central scotoma, as it is seen in cases of pressure on, or in disease of, the optic nerve. Here the temporal as well as the nasal half of the macular area is involved. The vision may be diminished down to eccentric vision of fingercounting at two meters. When the focus involves the chiasm from above, the field defects start in the inferior quadrants. When the focus involves the chiasm from below, the field defects start in the superior quadrants. If the focus involves the chiasm from in front, an optic nerve must be involved also, resulting in a central scotoma of that eye. If the focus involves the chiasm from behind, there cannot be a real central scotoma, for the nasal halves of both macular areas must be preserved.

The combination of these rules permits a certain degree of accuracy in the localizing of these lesions. Dr. Kestenbaum concluded by remarking that the

final diagnosis has to be made by the neurologist in conjunction with all other neurologic symptoms.

Dr. Kravitz (in closing) remarked that he agreed with Dr. Kestenbaum that experience in taking visual fields in brain tumors is very important. He said that tumors pressing on the chiasm far in front or in the back will show that anatomists are correct. The anatomic arrangement is important. All optic chiasms are not the same, nor are all optic nerves. Some are fixed by dura; some are short and some are long. If the chiasm is fixed, then early symptoms appear; if mobile, they take a great deal before showing defects. In general, there is confusion due to various anatomical changes and variations within the skull.

Bernard Kronenberg,
Secretary.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

October 24, 1946

DR. BURTON CHANCE, *chairman*

ADENOCARCINOMA OF LACRIMAL GLAND.

DR. I. EDWARD RUBIN (by invitation) presented a case of mixed tumor of the lacrimal gland, which is rare, there being less than 300 cases reported in the literature. Although it is the commonest disease of the lacrimal gland, the origin of this tumor is still a controversial subject. Grossly and histologically it resembles a mixed tumor of the salivary gland.

The signs and symptoms of mixed tumor of the lacrimal gland are those of a slowly progressive, unilateral, orbital tumor. These include proptosis with displacement of the globe downward and slightly nasalward. A mass felt in the

region of the lacrimal gland is a constant, diagnostic sign. There is also limitation of motion, diplopia, impairment of vision, fundus changes, usually no pain, lacrimation, and exposure keratitis.

Recurrence of this tumor frequently occurs. It is often incompletely removed, and has a strong tendency toward bony invasion. It may become malignant after many years.

X-ray therapy has little noticeable effect. Surgical removal is the best treatment, and should be as radical as possible. If bone is involved, it should be resected. If the orbital tissues are involved, an immediate exenteration is indicated. Four surgical approaches were discussed: the direct, the transeonjunctival, the Kronlein, and the frontal flap with removal of the roof of the orbit.

A case of mixed tumor of the lacrimal gland in a white man, aged 35 years, was presented. The case had been followed from childhood. When the patient was 10 years of age, proptosis was first noted. At the age of 16 years, a mixed tumor of the left lacrimal gland was supposedly completely excised. After 11 years, the tumor first recurred. It was again excised five years later when the patient was 33 years of age. Microscopically, the tumor was reported as a mixed tumor. Within 21 months it recurred, and this time it involved the optic nerve producing papilledema. Intracranial extension was suspected, so a frontal craniotomy with removal of the roof of the orbit was performed. This was followed by a complete exenteration of the orbit. A large tumor, apparently arising from the region of the lacrimal gland, extended posteriorly to compress the optic nerve. Pathologically, the tumor tissue was adenocarcinomatous.

In conclusion, Dr. Rubin thanked Dr. Spaeth for the privilege of presenting this very interesting and unusual case. He also acknowledged to Dr. Zentmayer that this

was a follow-up on the case he had reported 18 years ago, and thanked him for his cooperation.

Discussion. Dr. Jacob H. Vastine, 2nd, said that Dr. Rubin had made such a complete presentation of this subject that little remained to be discussed.

Surgery is probably the treatment of choice in cases of mixed tumors, whether of the salivary glands, nasal accessory sinuses, or lacrimal glands. In some cases, surgery is impossible or refused, and in these cases irradiation has value. This may be administered either as X-ray therapy, radium therapy, or both. The irradiation may be expected to effect regression of malignant tissue, and to retard the growth of the benign elements. There is sufficient proof of the value of irradiation to recommend it as a postoperative measure.

It is interesting to note that this patient was first operated upon in 1927. He received immediate postoperative X-ray therapy, administered by Dr. Henry Pancoast, and did not have a recurrence for 11 years. He was treated by me in 1939 and 1940, and the tumor remained quite stationary until 1944. He was again operated upon in 1944, and at that time received no postoperative roentgen therapy. It is quite striking that there was a rapid recurrence, and within two years another tumor was removed from the same site. This time it was malignant. The question may be asked whether postoperative treatment in 1944 would have delayed recurrence or malignant change. X-ray studies, made by me in 1939 and again in 1946, showed a pressure erosion of the roof of the orbit in the region of the lacrimal fossa. This defect remained unchanged.

Roentgenograms and photographs were presented of an unconfirmed case treated by Dr. Pfahler and me, in 1930. There was marked ptosis and proptosis which regressed following roentgen therapy

alone. The patient had been studied by Dr. Goalwine in New York, in 1930, at which time a defect in the lacrimal fossa of the orbit was found. This was similar to that in the case presented by Dr. Rubin. That patient was referred to Dr. Pfahler for roentgen therapy in 1930. A presumptive diagnosis of a mixed tumor of the lacrimal gland was made. Roentgen therapy alone was administered by Dr. Pfahler and by me. The patient was entirely well when last seen five years later.

Dr. Robert A. Groff congratulated Dr. Rubin on his excellent presentation and said that it was not only interestingly told, but also covered the subject thoroughly.

Prior to operation of the patient who constitutes the case report in the author's paper, it was thought that the orbital tumor had entered the orbit through the bony defect in the orbital roof, as seen in the X-ray pictures, or that it had extended along the optic nerve into the cranial cavity. When the anterior fossa was explored, there was no evidence of tumor. Upon removing the roof of the orbit, it was quite obvious that the tumor had extended throughout the tissue in the orbit, and it was difficult to identify normal structures. For this reason, he had contented himself with excising part of the tumor with the idea that Dr. Spaeth, at a later date, should remove the entire contents of the orbit.

The procedure of frontal craniotomy and removing the roof of the orbit is very simple and safe. It is done entirely extracranially so that the subdural and subarachnoid spaces are not entered nor contaminated. The exposure it affords of the structures in the orbit is excellent. It is recommended not only as an easier method to remove orbital tumors completely, but also as the procedure for decompression in exophthalmos. The procedure should be done jointly by the neurosurgeon and the ophthalmologist.

Dr. Edmund B. Spaeth (in closing)

said that as soon as the report of the biopsy from Dr. Groff's transfrontal operation had been received, a radical exenteration of the orbit had been done. The reason for the massive and immediate postoperative radium therapy was not because there originally had been a mixed-cell tumor, but because a clean, clear-cut, rapidly developing adenocarcinoma was reported.

One other case of mixed-cell tumor of the lacrimal gland is under observation, and we are wondering with this occurrence what is going to happen to that case. The case was operated, using the Kronlein technique, and received X-ray therapy in massive doses postoperatively. The report we received at the time of the surgery, after examination of a frozen section, was mixed-cell sarcoma. That is why we proceeded with massive X-ray therapy. Forty-eight hours later, a second report changed the diagnosis to mixed cell tumor. I am rather curious to know what is going to happen to this young lady. She has a practically complete ptosis following surgery, and declines surgery for this ptosis. I am not urging her. I would much prefer to let that alone for the time being. She is developing a sequestrum in the lateral wall of the orbit, and I would not be at all surprised if it becomes necessary to perform a sequestrectomy of that area of the zygoma.

PERIARTERITIS NODOSA

FRED HARBERT, CAPT. (MC), U.S.N. AND SAMUEL D. MCPHERSON, JR., LIEUT. (JG), (MC), U.S.N.R. (by invitation) presented a case of scleral necrosis in periarteritis nodosa which was published in the June, 1947, issue of the *JOURNAL* on page 727.

HYDRATION AND TRANSPARENCY OF CORNEA

WILLIAM M. HART, PH.D. (by invitation) said that recent work (Cogan and Kinsey, *Science*, 1942, volume 95, pages

607-608) has emphasized the degree of hydration as the chief determining factor in transparency of the cornea and as responsible for the optical difference between cornea and sclera. According to this concept, the cornea is endowed with a dehydrating mechanism to keep down its water content. When this mechanism fails, swelling occurs and, therefore, opacification. The sclera, on the other hand, is always opaque, because of the absence of any such mechanism. If, however, the sclera is deliberately dehydrated, as by drying in air or placing in glycerine, it also becomes "transparent."

In the present study, swelling and transparency of beef corneas were noted in various buffer solutions, all of which were adjusted to the same osmotic activity (8.94 atmospheres) by adding glucose. Throughout this study an absolute disparity was found between the degree of hydration and the turbidity of the cornea.

The cornea may be characterized as a lyophilic colloid system inasmuch as it shows behavior analogous to gelatin and fibrin under like conditions. Like many specimens of gelatin, it has an isoelectric point of pH 4.6 as shown by the swelling minimum.

Various factors were found to affect the transparency of the cornea independently of the water content. It is suggested that these factors operate by affecting the refractive index of the water or of the micelles, or both.

Affecting the micellar refractive index are: (1) temperature, (2) electrolytes, (3) isoelectric point, (4) dissociation, (5) association, (6) mechanical stresses (as in birefringence), (7) pH, (8) hysteresis, and (9) coacervate formation (due to protein-lipid-carbohydrate complexes).

Affecting the refractive index of the water are: (1) pH, (2) electrolytes, (3) nonelectrolytes, (4) surface tension, and (5) temperature.

According to this theory, when the re-

fractive index of the solvent water in the cornea becomes markedly different from that of the particles, turbidity results.

The practical potentialities of these observations were shown in the fact that it was possible to clear the corneal opacities which occur spontaneously in cattle. Further work will be directed toward such an attempt in the intact animal.

Discussion. Dr. Francis Heed Adler said that it would be very difficult for anyone to discuss this paper after hearing it for the first time, and it was quite impossible for him to do so, but he could not refrain from mentioning how delighted he was that work of this type was being done in Philadelphia. The results of investigations of this character do not remain long in the laboratory. They have definite practical significance.

A few years ago, Cogan in Boston, and others, began experiments on the permeability of the cornea and its property of imbibition, which are being applied in the clinic. They showed the the normal cornea soon becomes less transparent if bathed with a solution of ordinary normal salt or with hypotonic solution. In order to keep the cornea clear during an operative procedure, such as detachment of the retina, most surgeons now keep the cornea flushed with a salt solution of 1.5-percent strength. They also showed that most of the deleterious effect of cocaine solutions was due to the fact that they are hypotonic. The question of turbidity of the cornea with loss of its transparency becomes increasingly important with the operation of transplantation of the cornea.

For the last few years, Dr. Leopold has been interested in transplanting corneas from frozen dried material. Although these transplants take well, they soon become opaque and remain so. The answer to this problem is to be found in the kind of work which Dr. Hart is doing, and I trust that he will be encouraged to continue it.

Dr. William M. Hart (in closing) thanked Dr. Adler for his comment and said that, as shown in the data, the dehydrated cornea, when rehydrated, is often optically better than normal cornea. He and his co-workers were not aware of Dr. Leopold's work, of course, which was carried on under conditions of war secrecy, but the next point they had in mind was to try to transplant corneas from the dried state.

Opacity of the cornea is a very common condition in cattle. A number of such eyes were brought to the laboratory. Some of them had deep ulcer craters, which he presumed to be scar tissue. Such corneas can be cleared in one of two ways. They can be dried in air, in which case they become clear as normal corneas; or, they can be allowed to swell in appropriate strength hydrochloric acid or various buffer solutions. Those corneas which have been dried may be rehydrated and then do not again become opaque.

George F. J. Kelly,
Clerk.

CHICAGO
OPHTHALMOLOGICAL
SOCIETY

DR. WILLIAM A. MANN, *president*

October 17, 1946

CLINICAL PROGRAM

The clinical meeting was presented by the Department of Ophthalmology, University of Chicago.

BOECK'S SARCOID DISEASE

DR. BYRON L. GIFFORD presented two cases of this disease.

Case 1. Mrs. D. R., aged 36 years, was first seen in July, 1946, with a history of pain and redness in the right eye in September, 1945, followed by remission, and

exacerbation of redness in April, 1946, with concurrent redness of the left eye. At another clinic, a biopsy of a cervical lymph node had been made, chest films had been taken, and a diagnosis of sarcoid disease was made.

Aided vision was: R.E., 20/70; L.E., 20/30. Both eyes showed seroplastic uveitis without nodules. There was a heavy increase in aqueous flare with low cell count (2 to 3 per smallest slitlamp field), very large mutton-fat keratic precipitates deposited on the corneal endothelium, many heavy posterior synechiae, and an uveal pigment and cyclitic membrane on the lens capsule. The right eye showed more involvement than the left. The right fundus showed a red reflex only; in the left fundus, detail was blurred, but no pathologic condition was noted.

In August there was increased reaction in both eyes; vision decreased to: R.E., 20/300; L.E., 20/100. Two months later both eyes showed rather remarkable beginning spontaneous remission, especially the left eye in which aqueous-flare increase was minimal, with only an occasional floater, and marked decrease in the number of keratic precipitates. At this time vision was: R.E., remained 20/100; L.E., returned to 20/30+.

Only a single lymph nodule was found in the axilla. X-ray pictures of the chest showed large round hilar masses bilaterally with absence of parenchymatous lesions; no sarcoid rarefactions were noted in X-ray studies of hands and feet. Tuberculin sensitization, skin tests for lymphogranuloma, serology tests all gave negative findings.

Case 2. Mrs. J. J., aged 25 years, first noted a growth in her left eye in December, 1945. Prior to that time she had had a "nervous breakdown," with general weakness, marked tremor, and weight loss, without cough or elevation of temperature. A chest film taken in 1944 was

reported as negative. Her mother supposedly died from tuberculous infection.

When seen in March, 1946, the corrected vision was: R.E., 20/16; L.E., 20/100. The left eye showed a large, yellowish-pink, slightly lobulated tumor mass filling about one third of the anterior chamber from the inferior nasal limbus to the pupil and pressing against the cornea. This was seen to be attached to the iris and was covered with a fine network of vessels, all originating from the iris. The aqueous flare was increased. There were occasional floaters and many large mutton-fat keratic precipitates on the corneal endothelium. The 2-mm. pupil was fixed to the lens, which showed a complicated cortical cataract. No fundus details were seen.

In the right eye, the cornea was clear, with no increase in aqueous flare, no floaters, and no keratic precipitates. The iris showed two tiny bulges, about 1 mm. in size, near the limbus and at the pupillary margin. The pigment border of the pupil was slightly irregular with no frank pigment exfoliation.

During subsequent weeks, a sarcoid uveitis in the right eye was observed under the slitlamp, from the early incipient stage to a full-blown nodular and seroplastic type. The pupil border became stringy, the iris stroma appeared swollen, aqueous flare gradually increased, a few floaters appeared, and within five weeks, the tiny bulges of the iris pigment layer became typical Koeppe nodules. Abundant mutton-fat keratic precipitates were deposited on the corneal endothelium. More Koeppe nodules formed at the pupillary border, from which site posterior synechiae developed.

The skin of the flexor surface of both forearms showed many small subcutaneous nodules. X-ray pictures of the chest showed extensive infiltration at each hilus, along the mediastinum and in both upper

lobes, compatible with sarcoidosis. X-ray films of feet and hands showed no rarefaction. Routine serology and other laboratory and skin tests gave negative reactions. Biopsy of one of the subcutaneous nodules of the arm showed, on microscopic section, a mass of highly vascularized granulation tissue in which epithelioid cells were occasionally arranged to form tuberculoid structures with Langhans's type giant cells; no caseation necrosis was seen.

X-ray therapy to the tumor mass of the left eye was given at weekly intervals. At the end of the fourth week, the tumor mass appeared to shrink in size about 20 percent, but regained its original size during the remainder of 10 treatments.

When the patient was last seen in August, 1946, the vision of the right eye remained 20/13, but vision of the left eye was reduced to hand movements at two feet. Tension remained within normal limits during the time of observation.

TOXOPLASMOSIS

DR. BYRON L. GIFFORD said that A. P., a man, aged 38 years, was seen in September, 1946, with a history of poor vision in both eyes since childhood. The left eye had always been the better until five years ago, when vision gradually decreased until there was no light perception in this eye. Vision was: R.E., 9/200.

The right eye showed myopia of 3 diopters, a large macular chorioretinal coloboma, degenerative papulomacular bundle, temporal optic atrophy, anomalous retinal correspondence, at least 10 degrees nasalward and 10 degrees below the posterior pole. The left eye showed a microcornea (R.E., 11.5 mm., L.E., 9.5 mm.), iris rubeosis, blockage of angle of anterior chamber by the adherent iris root, and a bizarre complicated cataract with white, sculptured, statuelike opacity. The fundus showed an enormous posterior staphy-

loma. The eye was glaucomatous (Schiotz, R.E., 22 mm. Hg; L.E., 54 mm.). All laboratory tests were negative.

In spite of the lack of history of the sequence of events, the findings would indicate an early, possible fetal infection, leading to the numerous present complications. Tests will be made to confirm the diagnosis of plasmosis.

BILATERAL RETROLENTAL FIBROPLASIA

DR. BARBARA SPIRO presented a case of retrolental fibroplasia with fetal iritis and secondary glaucoma.

Case report. D. M., a white baby girl, aged 1½ years, was first seen in February, 1946. The baby and her twin brother were born after a 6½ months uneventful pregnancy; the boy died shortly after birth. The mother noted the girl's poor vision at the age of 3 or 4 months.

There was questionable light perception in each eye, the left apparently the better one. Bilateral enophthalmos and epicanthus were noted. The eyes exhibited bilateral searching nystagmus. The right cornea measured 8.5 mm., with central opacities; the left, 9 mm. Both anterior chambers were very shallow. Both irides were of fetal-blue color, atrophic and with vessel formation. Whitish nodules were noticed at the iris frill. The iris was bound down by extensive synechiae with a 2-mm. pupil; the left pupil could be dilated to 5 mm. The lenses were fairly clear and behind each one could be seen a whitish-gray mass with small blood vessels on the surface. On the left side, a few fundus vessels and a grayish-red reflex could be made out; on the right, nothing beyond the gray mass. Ocular tension with Schiotz and Souter tenometer was about 30 mm. Hg on the right and 15 mm. on the left.

Pediatric examination showed the baby to be normal otherwise, although some mental retardation was noted.

BILATERAL RUBEOSIS IRIDES

DR. BARBARA SPIRO said that D. P., a 49-year-old white man, was shown before this society in May, 1945. At that time he stated that his vision had started to diminish two years before. He had diabetes mellitus which was controlled with diet and insulin. Vision was: R.E., 20/100; L.E., 8/200. The striking findings were bilateral iris atrophy with rubeosis irides of the left eye, advanced diabetic retinopathy of both eyes, and rete mirabile of the right eye. Since that time the patient has been under good medical care. Vision has continued to decrease to hand movements at two feet in the right eye, and light perception in the left. He now has bilateral rubeosis irides, the retinopathies have become more marked, and he has bilateral rete mirabile.

BILATERAL RETROLENTAL FIBROPLASIA

DR. BARBARA SPIRO presented R. S., a 6-months-old white boy, first seen in September, 1946. He was born 2½ months prematurely after an uneventful pregnancy. The poor vision was noted at the age of 2½ months.

Examination revealed bilateral sunken eyes and bilateral nystagmoid ocular movements. The corneas were clear and measured 9 mm., horizontally. Both anterior chambers were extremely shallow. The irides were fetal blue in color, the pupils could be dilated to 3.5 mm., and the irides were bound down with numerous posterior synechiae. Some anterior synechiae were seen peripherally. The lenses were clear. Behind them were large whitish-gray masses, extending into and including the retinas. A red fundus reflex could be obtained in the periphery.

No other abnormal physical findings were noted. The psychologist reported a dull rating, but was optimistic concerning the child's development compared to that of similar premature blind babies.

RETINITIS PIGMENTOSA SINE PIGMENTO

DR. S. J. ALEXANDER said that this 31-year-old white man complained of poor night vision of 15 years' duration. Vision was: R.E., 20/16-2; L.E., 20/13-2. Examination revealed normal external eyes and normal anterior segments.

The fundi showed essentially normal discs, reduction in size of the vessels, and a very few small pigment clumps in the periphery. The retina had a slightly pale-gray, granular appearance. Visual fields revealed bilateral ring scotomas.

On questioning, the patient said he knew of no other similar eye difficulty in the family. However, his mother was examined a few days later and identical eye findings were seen.

OPTIC ATROPHY, RETROBULBAR NEURITIS, AND BRUCELLOSIS

DR. S. J. ALEXANDER presented C. S., a 22-year-old ex-marine, who complained of sudden loss of vision in the right eye one month previously. Several days later vision had returned to light perception, which did not improve. A tentative diagnosis of brucellosis was made because of a rather constant, low-grade fever, enlarged lymph nodes and spleen, and previous questionable blood cultures for *Brucella*.

Vision was: R.E., light perception and projection temporally only; L.E., 20/20+2. A right divergent strabismus was found. The adnexa and anterior segment were normal. The right pupil reacted weakly to light but well consensually; the left reacted well to light but poorly consensually, normally for accommodation. Examination of the fundi showed the right disc to be white and slightly elevated with blurred margins. The left disc was normal. The veins showed marked congestion, tortuosity, and segmentation. Arteries were tortuous and somewhat reduced in size. A few minute

striate hemorrhages were noted. The right foveolar reflex was absent. The left macula was normal. There was slight edema of both retinas.

To confirm the diagnosis of brucellosis, a lymph-node biopsy was taken. The section showed lymphoid lipoidosis of the Hand-Schüller-Christian type. The ophthalmologist, however, could only say that this was an aberrant form of optic atrophy.

OPTIC ATROPHY WITH ARACHNOIDITIS

DR. A. W. FELDMAN presented J. F. K., a white woman, aged 45 years, with a history of hypertension of 10 years' duration and various complications for which she had been under medical and surgical treatment since that time. An examination in April, 1946, disclosed papilledema with pallor of both discs and sluggish pupillary reflexes. In December, 1945, she had fallen, sustaining a Colles' fracture and a contusion over the right eye.

Ophthalmic examination in August, 1946, showed no light perception in either eye. Blood pressure was 242/130 mm. Hg. The pupils measured 5 mm. and were fixed. An irregular searching nystagmus was present. The discs were pale gray and showed 2 diopters of papilledema. There was peripapillary and perimacular edema bilaterally, but the maculas were not remarkable. The vessels showed irregularity of lumen size. The arteries were markedly sclerotic, some being of silver-wire variety, and the A.V. ratio was about 1:3. There were no hemorrhages or exudates.

Lumbar puncture revealed spinal-fluid pressure of 350 mm. which rose to 550 mm. with jugular pressure. The fluid was clear, and the Pandy test was negative. X-ray films revealed normal optic foramina. Subsequent ventriculography showed the ventricular system to be in

the midline and moderately dilated, with no apparent cause for dilation. Because of the history of injury, findings of bilateral optic atrophy, and increased intracranial pressure, with absence of X-ray or clinical evidence of intracranial neoplasm, a diagnosis of chronic arachnoiditis was made. A subtemporal decompression was performed in September, 1946, at which time it was noted that the arachnoid was grayish and thickened along the vessels of the cortex; elsewhere, it appeared essentially normal. Postoperative lumbar punctures were done daily and then every two days. She was free from headache when discharged to be followed in the neurosurgical outpatient department.

FAMILIAL RETINAL HYPOPLASIA WITH NYSTAGMUS

DR. A. W. FELDMAN presented four patients with familial retinal hypoplasia with nystagmus because of the findings in a father and three children.

Case 1. R. T., a white man, aged 38 years, gave a history of poor vision for as long as he could remember. He had first worn glasses at the age of 10 years. His father and three siblings were myopic. There was no family history of night blindness. Vision was: R.E., 20/70; L.E., 20/100. The right vision could be corrected to 20/30; the left was unchanged. Examination revealed a right divergent squint of 10 degrees, a coarse horizontal nystagmus, and normal anterior segments. The fundi showed bilateral thinning of the retinas and normal discs, vessels, and maculas. Bjerrum fields were within normal limits.

Case 2. The son, aged eight years, had worn glasses since the age of four years. Vision was: R.E., 20/50-2; L.E., 20/70+1; corrected to 20/50-2 in each eye. There was an alternating convergence of 10 degrees with preference for right-eye fixation and a coarse nystagmus. The fundi showed the retinal thin-

ning noted in the father's eyes.

Case 3. A five-year-old daughter had never worn glasses but her parents had noted poor vision and nystagmus. Vision was: R.E., 20/100; L.E., 20/70-1. There was an alternating convergence of 15 degrees with preference for left eye fixation, coarse nystagmus, and retinal thinning bilaterally.

Case 4. Another daughter seen one year later at the age of eight years had worn glasses for three years. Vision was 20/40-2 in each eye, improved with correction to 20/40+3 in the right eye, and 20/50-2 in the left eye. There was an alternating convergence of 15 degrees with preference for left-eye fixation. The same type of nystagmus and bilateral retinal thinning was noted.

VON RECKLINGHAUSEN'S DISEASE

DR. PAUL G. WOLFF presented H. F., a 30-year-old white man, who was seen in consultation with the Surgery Clinic following plastic repair of the left temporal area. He was born with a mass of neurofibromatosis of the left side of the head.

Examination showed an extensive soft-tissue lesion of the left side of the head from the orbit to the occiput, with underlying bony changes, left optic atrophy, right and left gray choroidal lesions interpreted as fibromata, numerous small nodules of right and left irides, increased visibility of the corneal nerves, café-au-lait spots, and small soft painless nodules of the skin. The movement of the proptosed and grossly displaced left globe was disturbed and caused occasional diplopia in spite of the low (6/200) acuity. The patient's I.Q. was seemingly normal. No information of value as to heredity factors was available.

GROENBLAD-STRANDBERG SYNDROME

DR. C. KEITH BARNES said that J. B., a 46-year-old white man, gave a history

of intraocular hemorrhages for 23 years. The patient stated that he bruised easily and that his dentist had always been uneasy about his bleeding.

Examination disclosed a classical picture of Groenblad-Strandberg syndrome. There were extensive angioid streaks of both fundi; extensive central chorioretinal scarring with macular involvement from resorbed choroidal hemorrhages, extensive pseudoxanthoma elasticum of the neck, axillae, cubital fossae, abdomen, inguinal areas, and rhomboidal fossae. The corneal microscope showed irregularities and sacculations of the subconjunctival arteries. Skin biopsy showed degeneration of the elastic tissue. The laboratory studies were negative except for a bleeding time of 4.5 minutes and a strongly positive intradermal test with brucellergin.

RIGHT AND LEFT TETANY CATARACTS

DR. C. KEITH BARNES said that the above diagnosis was made eight years ago when H. W., a 32-year-old man, was first seen. He gave a history of convulsions in infancy, but did not have any details. No definite evidence of parathyroid deficiency was established. The basal-metabolism rate was rather low. Blood chemistry was within normal limits.

On examination, symmetrical opacities of the lens of the right and left eyes were seen. These were of classical appearance. They were uniform, translucent, ghostlike shells of punctate opacities, surrounded by clear cortex and completely surrounding clear nuclei.

RETINAL ATROPHY WITH MACULAR DEGENERATION

DR. F. S. RYERSON said that B. W., a man, aged 36 years, complained of loss of central vision. Over a period of 12

months, beginning in 1944, his ability to read, recognize people, and judge targets steadily decreased. He was discharged from the Army with the diagnosis of bilateral macular degeneration. He could read newspaper headlines and could recognize people only within a short distance. He had noticed only slight loss of color perception. Examination at the age of 27 years was said to have shown good vision. He said the fundusoscopic examination was negative.

The patient had 15 brothers and sisters. Of these, two brothers and one sister had developed the same symptoms. One other brother and two other sisters had ocular deficiencies of undetermined nature. The other siblings and the parents apparently had no ocular defects. Three cousins had serious ocular defects.

The patient had visual acuity of 20/200 in each eye. The Bjerrum fields were essentially normal with the exception of bilateral central scotomas. Fundusoscopic examination revealed normal optic discs and normal vasculature. The macular areas showed fine granular pigmentation and loss of the foveolar reflex. They had a punched-out appearance. A few small glistening hyaline particles were seen. Peripherally, a few small pigment clumps were noted. Hearing tests, medical and neurologic examinations were negative. Serology reports were consistently negative.

SCIENTIFIC PROGRAM

- Keratoplasty (movie demonstration)—
Dr. R. T. Paton (by invitation) New York, New York.
A New Classification of Strabismus—
Dr. S. V. Abraham (by invitation) Los Angeles, California.

Richard C. Gamble,
Secretary.

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OPTICAL REBATES

At the June meeting of the American Medical Association, ophthalmologists and the Section on Ophthalmology came in for severe criticism and condemnation from the House of Delegates for accepting and permitting acceptance of optical rebates. This unethical practice has officially been censured by means of a resolution of many years' standing in the Section. There is no question that a very large number of members of the Section have given this resolution lip service only.

The subject has been discussed formally at many meetings of the Section.

Members will recall the effort some years ago to make the practice more acceptable by notices displayed in some physicians' and in certain opticians' offices to the effect that the optician was acting as the physician's agent only. By this subterfuge, which one can be sure was not thoroughly understood by the patient, the optician dispenses the glasses and turns back to the physician a certain percentage of the profit.

That the government does not consider this to be a sound and honest business practice is shown by the civil suits initiated a short time ago in various parts of the country, on the part of the Attorney General against certain optical houses and certain physicians. These cases have not as yet been tried and, therefore, no comment at this time is warranted, except to say that the choice of the ophthalmologists who must defend themselves appears to be pretty haphazard and unfair, like picking names out of a hat. The government's answer to this complaint appears to be that there are so many ophthalmologists involved it would be impracticable to bring them all into court.

The acceptance of optical rebates is a vestigial practice left over from the days when physicians accepted kickbacks from druggists and undertakers and split fees with other physicians and professional men. Medicine has pretty well cleaned its house of the latter practices, although fee splitting and other kickbacks undoubtedly take place here and now. The splitting of fees among physicians is certainly an infrequent event now days. On the other hand, the acceptance of rebates by ophthalmologists is unfortunately nearly universal, judging from reports from various sources.

Why should this be? The argument most frequently heard is that the patient is unwilling to pay the full fee to which the ophthalmologist is entitled because of his long years of training in a special, skilled field of medicine. Therefore, part of this fee must come from the sale of glasses. Most ophthalmologists are unwilling to place optical shops in their offices, or to do the fitting themselves, or to hire an optician to do it for them. Many, however, particularly those in the smaller communities, do just this. There is nothing unethical about it, although it

is a little repugnant to a professional man to conduct an optical business on the side. But the conscientious ophthalmologist, placed in this position, will do the optical work or see that it is done under his direct supervision and business responsibility, in order to render the best service possible to his patients.

What wrong then is done if an optical house acts for the ophthalmologist as his agent? Simply this. The ophthalmologist has no responsibility, financial or otherwise, in the running of the optical house. Theoretically, he can determine the price of the finished product under this arrangement. Practically, however, the cost of the frames and lenses is pretty well established for him, and it is at this point that the government becomes interested. The ophthalmologist, therefore, is given the difference between the wholesale cost of the glasses plus a profit to the optician and what the patient pays. The physician neither sells goods nor renders fitting service. The patient rarely understands the mechanism and the cost of the spectacles is maintained at a high level.

Many optical houses don't even bother to display a sign mentioning the agent status. Cynically, these places will notify the ophthalmologist from time to time that a certain sum is credited to him, and at the end of the month a check is sent him, with or without an invoice. One can be very sure that the patient knows nothing whatever about this deal.

Rebates form a substantial part of the ophthalmologist's income and once he becomes seduced by this pernicious and unethical practice, he is pretty well lost. If his conscience pricks him, he stills it by saying that the rebate is part of his fee. The young man, just starting into practice in a community, soon finds himself, frequently against his will, compelled to accept rebates. Pressure is placed on him by other ophthalmologists and by the opti-

cal houses themselves. If he remains firm in his conviction, he is forced into dispensing his own glasses received from a reluctant wholesaler.

In a number of instances, the ophthalmologist will accept the rebates and turn them over to a clinic or hospital or, perhaps, to some charity, thus salving his conscience, but also, at the same time, keeping alive this vicious and seductive practice.

The optical houses are eager to keep this system alive because, although it is a bookkeeping nuisance to them, the optometrist and the department store dispensers of lenses, which far outnumber the ophthalmologist, can charge the full rate for the glasses and pocket the difference between cost and selling price as their profit on the examination and dispensing. It will be illuminating and instructive to follow the government suits to see how this matter of price fixing is developed. It is obvious that the patient of the ophthalmologist who does not accept rebates, and there are a number of them, and the patient of the one who does pay the same price. The former is thus penalized financially, and it may well be that the reputable ophthalmologist is shunned because his fee is too high.

What can be done about it? The optical houses can be forced by the government to turn back the rebate to the patient himself. This is possible, but not likely at the moment, for the opposition by the optometrists and department stores is a powerful one. The only other escape is for each ophthalmologist to refuse to take rebates in any form whatever, charge and collect his own fee based on the value of his services to the patient, and to inform the latter so that he thoroughly understands that the price he pays for glasses is that set by the opticians and the optical houses. The patient must be made to understand that in so paying this high charge

for his spectacles he is subsidizing the optometrist and department-store dispenser, and that the ophthalmologist receives no part of the transaction.

This is an exceedingly difficult thing to do, especially in the smaller communities and by the young ophthalmologist. Many patients will turn to the optometrists, and the physician's income will be greatly cut. However, the ophthalmologist will sleep better at night and enjoy his own company and that of his colleagues more. In time, which will be the shorter the sooner all ophthalmologists get together, the public will know what is going on and the prestige of ophthalmology, grievously hurt by this practice, will rebound to its proper stature.

Why should the ophthalmologist cheapen himself and his great service for the benefit of the optometrist?

DERRICK VAIL.

WILMER RESIDENTS ASSOCIATION

The sixth clinical meeting of the Wilmer Residents Association was held at the Wilmer Ophthalmological Institute, on April 17, 18, and 19, 1947. The individual presentations will, in time, be published and become available to all, but viewing the program as a whole gives an insight into the scope and caliber of the work being done at Wilmer Institute—a view that is not obtained by reading separate papers. Then, too, as publication is often delayed, the program should interest a reader of the JOURNAL, since it indicates where and by whom authoritative investigation is being carried on in relation to particular subjects in which the reader may have special interest.

On the first morning staff rounds were held in conjunction with the medical department, the subjects of "Sarcoidosis" and "Progress of Arteriolar Disease" be-

ing reviewed. Dr. Alan Woods and Dr. Jonas Friedenwald discussed the eye aspects of the cases. Dr. McGee Harvey, Dr. Murray Fisher, and Dr. James Bordley presented the medical aspects. It was indeed enlightening to hear such authorities discourse about these subjects.

The formal eye program followed. A paper on "Ocular Effects of Tridione," a new anticonvulsant, was presented by Dr. Louise Sloan. Approximately 30 percent of patients being treated with tridione (3,5,5-trimethyloxazolidine-2,4-dione) report some degree of glare when going from indoors to brightly lighted outdoors. Because of the glare effect, objects at a distance appear indistinct and colors seem faded. The intensity of symptoms is related to the dosage of the drug. Photophobia begins within 10 days after medication is started, and disappears within a week or two after its discontinuance. The eyes appear normal to examination. In order to understand the photophobia, visual acuity, light discriminatory sense, and flicker phenomena were studied under a variety of illuminations, and it was found that visual acuity and light discriminatory sense were definitely diminished, particularly under conditions of bright illumination; whereas, they were relatively normal with low illumination.

Dr. William Owens, the senior resident, presented cases of "Retrolental Fibroplasia" that had been under observation since birth, and in which the gray opacity behind the lens had been observed in the process of development. He felt that 15 percent of very premature babies, and about $3\frac{1}{2}$ percent of all premature babies would show retrolental fibroplasia. It will be remembered that Dr. Terry found about 12 percent in his series of premature infants. The process is not considered to be related to remnants of the hyaloid system.

"Roentgen Irradiation in the Treatment of Ocular Diseases Characterized by New-Formed Blood Vessels" was the subject of a presentation by Dr. Jack S. Guyton and Dr. Algernon B. Reese. Cases of Eale's disease and diabetic retinitis proliferans were cited, and favorable results were obtained. The X-ray technique was similar to that used in the treatment of retinoblastoma. Special X-ray portals, developed at the Cancer Memorial Hospital in New York, are needed.

Dr. Maumenee presented a paper entitled "Experimental Study of Corneal Transplants," which will be published in the near future.

Dr. John M. McLean showed the technique and examples of "Surgery of the Paretic Inferior Oblique." The muscle is advanced onto the sclera beyond the insertion, in line with the insertion. The results were very satisfactory. Overcorrections can be obtained.

A clinical pathologic conference was conducted by Dr. Snip and Dr. Friedenwald, demonstrating interesting cases that had been seen at the Institute, with pathologic sections.

On the second morning the program began with a paper by Dr. Robert E. Kennedy on "Cystic Malignant Melanoma of the Uvea." "The Role of Rutin and Anticoagulants (Dicumarol) in Retinal Vascular Disease" was the subject of Dr. Angus L. MacLean's paper. "Tantalum Implant for Glaucoma" was discussed and demonstrated by Dr. Malcolm W. Bick.

"A Fixation Light for Testing the Six Cardinal Positions of the Eye" (see the JOURNAL, volume 30, page 611) was demonstrated by Dr. William C. Owens. The apparatus is set up so as to keep the light fixated at the same distance from the eye in all cardinal positions, and allow the examiner's hands to be free for using prisms or for the cover test.

Dr. Jonas Friedenwald presented an

impressive summary of his "Studies of the Physiology, Biochemistry, and Cytopathology of the Cornea in Relation to Injury by Mustard Gas and Allied Agents." Dr. Albert Snell and Dr. John Schilling gave an interesting paper on the "Use of the Anterior Chamber of the Eye in Cancer Research," demonstrating the conditions which are favorable and unfavorable for growth of tissue in the anterior chamber.

Dr. Alan C. Woods spoke on "Chemotherapy in Ocular Tuberculosis." Diasone appeared to have a beneficial effect with immune, allergic rabbits, although its clinical trial in the treatment of tuberculosis has yielded disappointing results.

"Injection of Saline into the Eye in Retinal Detachment" was discussed by Dr. Guyton. Drainage holes were made in the sclera over the detachment, and as much as 10 to 20 cc. of saline were injected into the vitreous cavity. This ran out of the drainage holes, and the flow of current tended to force the retina back against the sclera. Coincidentally, a fluid vitreous was created which may, in some cases, allow the retina to settle down. This method of treatment was used only in special cases—when previous operations were unsuccessful, in some aphakic eyes, and when the retina remained elevated after other drainage procedures had been tried.

Dr. Samuel D. McPherson, in his paper on "Sympathetic Ophthalmia," stated that a high percentage of cases of sympathetic ophthalmia show a positive skin test for sensitivity to uveal pigment, as judged by biopsy of the skin at the site of the injection of pigment. Dr. McPherson assumes that the sensitivity reaction allows the etiologic agent to become effective. Sensitivity is also present in cases of trauma and Vogt-Koyanagi syndrome, but in a much lower percentage of cases than in sympathetic ophthalmia. The

sensitivity is not due to the melanin, but to the cellular substance in which the melanin granules appear.

Dr. Charles E. Illiff demonstrated a "New Type of Beta-Ray Applicator." The Burnam-type applicator, previously described by him, utilizes the radon bulb. This bulb is a container filled with the gas, radon, which is a breakdown product of radium. A small window in the covering of the bulb allows a point source of radiation of high intensity which is ideal for occluding blood vessels. Because radon is so difficult to obtain, a new applicator was devised which uses the radium salt spread over the plaquelike end of the applicator. The radon is held in the interstices of the radium salt, and Beta rays are given off as surface fire rather than a point source, as in the Burnam applicator. However, only 50 mg. of radium can be spread on the applicator surface, or the radium itself will act as a filter to lessen the relative ratio of Beta to Gamma rays. The new applicator delivers per unit area only one fourth to one fifth the amount of Beta radiation delivered by the radon bulb of equivalent strength. This limits the use of the new applicator to conditions that can be treated by surface fire. These conditions are vernal conjunctivitis, tuberculous scleritis, and small tumors of the anterior segment. It is not practical to attempt to occlude blood vessels with surface-fire therapy. A special holder is made for the applicator.

On the third morning, the first speaker was Dr. Wilhelm F. Buschke, and his subject was "Experimental Production of Dinitrophenol Cataract in Chickens."

"New Types of Plastic Implants after Enucleation" were demonstrated by Dr. Russell T. Snip. The Guyton implant proved most satisfactory in his hands.

"The Oculocardiac Syndrome: Differential Diagnosis" was the subject of Dr. Frank B. Walsh's presentation. He

stressed the importance of recognition of this syndrome in cases of facial injuries, for, if it were not diagnosed, intracranial lesion might be suspected to be the cause of vagal stimulation, when actually it would be due to injury to the eye.

"The Use of Di-isopropyl Fluorophosphate (D.F.P.) for Glaucoma" was reviewed by Dr. William G. Marr. He stated that when pilocarpine, furmethide, or eserine fail to hold the tension, D.F.P. will not hold it either. Administration of D.F.P. to many patients causes discomfort because of the extreme miosis and ciliary spasm. Some patients have shown sensitivity to peanut oil, the vehicle for D.F.P.

"Use of Furmethide for Glaucoma" (see this JOURNAL, page 999) was discussed by Dr. Ella Uhler Owens. In early cases mecholyl and prostigmine were found to be more satisfactory, and furmethide more effective in late cases. Furmethide is often effective where pilocarpine and eserine have failed, especially in cases with high tension and complications, as after venous closure. Furmethide is now available through Smith, Kline, and French Laboratories, Philadelphia.

The final paper by Dr. Samuel Talbot and Dr. Stephen Kuffler was entitled "Apparatus for Chromatic Stimulation of Single Nerve Fibers of Mammalian Retina. Demonstration of Corneal Potential."

The organization of the program, to interest both the research worker and the practical clinician, and the manner of delivery of every speaker as well as the wealth of information presented were an inspiration to those attending the meeting, and a tribute to the Professor of Ophthalmology of Johns Hopkins University, Dr. Alan C. Woods.

S. RODMAN IRVINE.

OBITUARY

EDWARD COLEMAN ELLETT
(1869-1947)

Edward Coleman Ellett, known affectionately as "The Colonel" to all who attended the meetings of the Ophthalmic societies, died of coronary occlusion in the Atlantic City Hospital on June 7th. After attending the session of the Ameri-



Blackstone Studios, New York

EDWARD COLEMAN ELLETT

can Ophthalmological Society at Hot Springs, Virginia, with Mrs. Ellett, he was stricken on the train en route to the Centennial Celebration of the American Medical Association. Aware for the previous 18 months of the possibility of such an end, his interest in medicine and his specialty drove him to attendance at all meetings, local and national, and to active participation in the discussions. He never failed to contribute some worthwhile suggestion in the field of ophthalmology.

He was born in Memphis, Tennessee, December 18, 1869, the son of Judge Henry T. and Katherine Coleman Ellett. His formal education was received in Memphis private schools, Southwestern Presbyterian University at Clarksville, Tennessee (now Southwestern College at Memphis), and the University of the South at Sewanee, Tennessee. Both schools at later dates conferred upon him honorary degrees, Southwestern College the degree of doctor of law, in June, 1942, and the University of the South, the degree of doctor of science, in June, 1943. Dr. Ellett studied medicine at the University of Pennsylvania from which he received his doctor-of-medicine degree in 1891 and from which he was graduated as top man in the class. An internship at St. Agnes Hospital and a residency at Wills Eye Hospital, Philadelphia, prepared him for a long life of service in his home community. This service was acknowledged by his colleagues with a testimonial dinner in May, 1943, to celebrate his 50th year of active practice of medicine in Memphis.

In 1896, he was married to Nina Polk Martin and with her, last year, celebrated the 50th anniversary of a marriage which has been a symbol of love and devotion. Their mutual interest allowed them to enjoy many things in common, especially travel. Almost every summer they went to Europe, usually stopping in southern France, which both of them loved so well. They travelled in South America several times and made numerous trips to Havana. Wherever they might be, Dr. Ellett sought out the ophthalmologists, making firm friendships, which have endured, and picking up any new procedures and techniques which he could fit into his own surgical program.

"The Colonel" was a great teacher. For 16 years he was Professor of Ophthalmology at the University of Tennessee

Medical School, but his main interest was in graduate teaching in ophthalmology. In this field he had many associates in his private office, who later branched off into their own practices in Memphis and other cities, continuing successfully the precepts he taught so well. At his own expressed wish 11 of them were honored by being asked to carry him to his last resting place. His interest and regard for them were maintained until the very end.

Dr. Ellett's interests were mainly in clinical ophthalmology and his papers were based, as a rule, on the experiences of actual practice. Too numerous to record, there is scarcely a one which cannot yet be read with profit. He attended medical meetings religiously and was an active participant in discussions, disclosing a tolerant attitude toward the opinions of others but being firm in his own convictions. His tall, spare, and erect figure, was a familiar sight whenever the Academy, the A.O.S., or the Section on Ophthalmology was in session. During intermissions he was usually engaged in conversation with someone who had a problem to solve. Or, he was passing on the most recent anecdote which had come to his attention, for he loved a good story and told it well.

He delighted in the success of those men on whom he had exercised some influence through hospital connections, military life, or acquaintance at ophthalmic meetings. No request for advice was ever refused and, because of his long years of experience and scientific training, he usually had some worthwhile suggestion to offer. As a consultant, he was understanding and kindly and had the ability to alter a course of therapy without destroying the patient's confidence in his physician. His mind was always active and alert. If a certain form of treatment proved unavailing, he never hesitated to change to another even though the sug-

gestion might come from the most recent of his associates. He respected the dignity of man and was always willing to concede the merit of an idea and place proper credit where it was due.

I well remember the incidents of our first meeting, 21 years ago, and the conversations relative to the long and pleasant association which we enjoyed through all those years. After satisfying ourselves that such an association might be mutually agreeable, the question arose as to the need of a written contract. "The Colonel's" remarks were, "Doctor, I don't think we need one. An association in the practice of medicine is like a marriage. It will either work or it won't and if it won't work, a written contract isn't going to make it do so." It was on such terms that our association persisted and our relations were more like those of father to son than as senior to junior partner.

One idolizes and idealizes someone he loves, and the tendency is to allow sentiment to gloss over such defects as become apparent when the initial enthusiasm of a new association tends to wane. I never had cause to regret the good fortune which brought me to an association with Dr. Ellett. During all those years, there was never a serious difference of opinion, although one's opinion was frequently required; and at the close of 21 years of daily contact my love and respect for Dr. Ellett were exactly the same as when formed at the initial meeting. Dr. Ellett's professional ability and integrity, his innate courtesy, his genuine kindness and interest in the troubles of others always made him a tower of strength to his family and his friends in moments of personal distress.

His professional attainments and honors were most numerous. He belonged to every local, state, and national medical organization both in general medicine and his specialty. He had served as president

of the Memphis and Shelby County Medical Society, the Memphis Society of Ophthalmology and Otolaryngology, the Tennessee Academy of Ophthalmology and Otolaryngology, the American Academy of Ophthalmology and Otolaryngology, the American Board of Ophthalmology, and the American Ophthalmological Society, and was chairman of the Section on Ophthalmology of the American Medical Association and vice-president of the Southern Medical Association and the National Society for the Prevention of Blindness. He had served as an associate editor of the AMERICAN JOURNAL OF OPHTHALMOLOGY.

The Academy honored him with the Award of Merit; the Board, with a testimonial silver tray; and the National Society for the Prevention of Blindness, in conjunction with the St. Louis Society for the Blind, awarded him the Leslie Dana Medal. The Memphis and Shelby County Medical Society and the Memphis Society of Ophthalmology and Otolaryngology honored him on separate occasions with testimonial dinners.

During World War I, Dr. Ellett commanded Base Hospital 115 at Vichy, France, for which he received a citation for meritorious service. While in the Medical Corps, he was made a full Colonel, a title by which he was known the rest of his life.

Dr. Ellett was a member of Calvary Episcopal Church.

His fraternal orders were Kappa Sigma and Phi Alpha Sigma, and he belonged to the Memphis Country Club and the University Club of Memphis. As a member of the Waponoca Club, he was able to satisfy his enthusiasm for golf, tennis, and hunting—sports which he thoroughly enjoyed to the very last. "The Colonel" had an inner drive toward perfection which motivated his every action. He was constantly learning. At 60 years of age, he

took lessons to improve his Spanish and his backhand in tennis, with considerable success in both efforts. He was always willing to impart any such knowledge to those who desired it. Never will I forget the occasion, when my golf ball was lying against a fairway bunker and I insisted, with the usual result, on using the wrong club to gain distance. On my desk the following morning was an illustrated book on golf, opened to the page showing the exact situation of the previous day and demonstrating that a nine iron was the only club of choice. A good shot, Dr. Ellett enjoyed gunning afield for quail and pheasant and over the water for ducks and geese, and some of his most pleasant reminiscences were of days in the open.

Despite his love of sports and interest in medical affairs, Dr. Ellett's devotion to his patients and their devotion to him was inspiring. No complaint was too trivial to be heard to the end and no one suffered more than he did if a case of failing vision could not be halted or if sight could not be restored. His interest in the welfare of his patients was sincere and sustained, and regardless of the condition of his own health, he somehow always had time for those requiring his services. He was never too busy to stop to listen to a disconcerting problem or to have a look at the patient who was not doing well. Always there was some beneficial suggestion or the kindly assurance that all that was possible was being done.

A deft surgeon, Dr. Ellett pioneered in this country many of the surgical techniques that are now standard procedures, such as intracapsular cataract extraction with the corneoscleral suture, the Elliott corneoscleral trephining, the diathermy treatment of retinal separation, and plastic dacryocystorhinostomy. He was the center of a large audience in the operating theatre and never failed to give his most masterly performance in the presence of

on-lookers. He maintained his steady and accurate hand to the very last and, although restricting his office practice to consultation only, continued his intraocular surgery daily until the end. It was always an inspiration to watch him at work for there was a minimum of action, everything being done in the simplest and most direct way to achieve the desired result. His techniques and teachings were indelibly impressed on a large number of associates and residents, and he will live on in the works of those who were his students.

Wise counsellor and staunch friend, it seems strange not to hear his light footfall and feel his firm hand on one's shoulder as he comes to the examining room to impart a bit of advice or some news of mutual interest. But his influence will endure and mold the lives of all who knew him.

RALPH O. RYCHENER.

BOOK REVIEWS

A TREATISE ON GONIOSCOPY. By Manuel Uribe Troncoso, M.D. Philadelphia 3, Pennsylvania, F. A. Davis Company, 1947. 318 pages, 117 illustrations (35 in color), index, and bibliography. Price \$10.00.

The important pioneer work on this subject and the instrumentation devised by the author are too well known to need comment. This book represents the crowning achievement of a lifetime devoted to the study of the angle of the anterior chamber by Dr. Troncoso. It is clearly written and illustrated and is a work of great significance in ophthalmology.

Gonioscopy, or the art of examining and interpreting the conditions seen in the anterior chamber of the living subject, has had a difficult evolution. It has

taken many years to attract the attention that it deserves, and it is only in recent time that the procedure is becoming more popular. Part of this delay has been the somewhat time consuming and difficult technique hitherto necessary. In these days of overburdened practices, the ophthalmologist hesitates to devote any time to a study that seemed to offer so little reward to the patient or to himself in adding to the judgment of the case. More and more information appearing in our literature is coming from authorities whom we have learned to respect and trust, and more and more converts are being made. Improvements in the instrumentation and in the technique, owing in very large measure to Dr. Troncoso's scientific outlook and acumen, have made the procedure much less formidable and time consuming. Gonioscopy is not yet as easily done as are slitlamp microscopy or ophthalmoscopy, but it is rapidly approaching these maneuvers in ease of accomplishment and clinical importance.

The author's timely book sets forth in clear terms the interpretation of the various findings in the anterior chamber in health and disease. Attention is directed to the importance of a visual study of the angle in various kinds of glaucoma, as an aid particularly in the choice of an operation or in the analysis of its failure. Inflammatory conditions, tumors, foreign bodies, congenital anomalies, and changes in age affecting this area are a part of gonioscopy, as developed by the author. Prof. Ida Mann has written, especially for this book, a chapter on "Development of the Angle of the Anterior Chamber in the Human Eye," which is a classic.

The publishers have done a splendid

job. The book is beautifully printed, and the illustrations, particularly the colored ones, are to be commended. It is a pleasure to possess this book and to use it, and it is inconceivable that any ophthalmologist would deny himself this pleasure, especially in a world so full of woe.

DERRICK VAIL.

UEBER NICHT HYPOPHYSÄRE CHIASMASYNDROME. By M. Gil. Espinosa (Madrid). Supplement of *Ophthalmologica*. Basel, Switzerland, S. Karger, 1946. 60 pages, 15 illustrations, paperbound. Price 7.50 Swiss francs.

This well-written monograph adequately discusses what is known as the Chiasmal Syndrome, a term coined by Cushing, who presented a paper with this title before the International Congress of Ophthalmology in Amsterdam, in 1929. (*Archives of Ophthalmology*, 1930, volume 3, pages 505 and 704.)

After a description of the signs and symptoms of a lesion in the chiasmal area, the author discusses the nature of the lesions and the differential diagnostic points of significance. There is thus presented a short analysis of hypophyseal adenoma, craniopharyngioma, tumors of the IIIrd ventricle and of the infundibulum, arachnoiditis opticochiasmatica, glioma of the chiasm, aneurysm, granuloma, suprasellar cholesteatoma, meningioma of the base of the skull, and indirect compression of the chiasm. However, not much has been added to the subject so ably expressed by Dr. Cushing and other American authors.

DERRICK VAIL.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

6

CORNEA AND SCLERA

Fuchs, Adalbert. The influence of general metabolic and nutritional disturbances upon the resistance of the cornea. *Amer. Jour. Ophth.*, 1947, v. 30, June, pp. 721-727. (5 references.)

Harbert, F., and McPherson, S. D. Scleral necrosis in periarteritis nodosa. *Amer. Jour. Ophth.*, 1947, v. 30, June, pp. 727-732. (6 figures, 11 references.)

Morone, G. Researches on the sensibility of the transplanted corneal discs in keratoplasty. *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 72, May, pp. 279-297.

The author presents 11 cases of keratoplasty in which the sensibility of the cornea with respect to touch, temperature, and pain was tested with the esthesiometer and technique of Puglisi-Duranti. The transplanted disc, whether it becomes opaque or remains transparent and unvascularized, may acquire a sensibility of its own after the lapse of a year. Such sensibility is always inferior to that of normal cornea, and the cornea of the host is often

hypesthetic as well. A warm stimulus is usually well perceived as such. The sensibility of the transplants seems to depend but little on the nature of the postoperative course, on the age and sex of patient and donor, and on the width of the cicatricial band around the transplant.

The anatomy of the innervation of the cornea and the physiology of its sensibility are reviewed.

Harry K. Messenger.

Seidenari, R. Histologic aspects of refrigerated corneal epithelium. *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 72, May, 298-316.

A detailed study is presented of the histologic changes that occur in the epithelium and in Bowman's membrane of refrigerated and nonrefrigerated human corneal tissue, specimens of which were examined at $\frac{1}{2}$, 2, 5, 10, 24, 36, and 48 hours after death. (The article is accompanied by a complete series of comparative photomicrographs.) The refrigerated corneal tissue was kept in small glass vessels surrounded by finely

chopped ice; the controls were kept at room temperature.

Exfoliation occurred in both instances, but sooner and more rapidly in the nonrefrigerated cornea, whereas the histochemical properties of the cytoplasm and nuclei of the cells of the basal layer remained nearly normal for 48 hours in the refrigerated tissue. Likewise the refrigerated tissue remained acidophilic much longer. There was no essential difference in the behavior of Bowman's membrane.

Harry K. Messenger.

Seidenari, R. Histologic aspects of refrigerated corneal parenchyma and endothelium. *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 72, June, pp. 363-375.

A comparative histologic study was made of the condition of refrigerated and nonrefrigerated corneas at intervals of one half to 48 hours after death. The nonrefrigerated corneas were kept at room temperature; the others were refrigerated in a small glass container surrounded by melting ice. It was found that in the refrigerated specimens the thickness of the cornea is less than in the nonrefrigerated, and the thickness of Descemet's membrane is practically unchanged. In the refrigerated group the normal acidophilic properties of the tissues are retained even after 48 hours, whereas they disappear by the fifth hour in preparations not exposed to the action of cold. Likewise the individuality of the lamellae is preserved even after 48 hours of refrigeration, whereas dissociation begins four hours after death in the nonrefrigerated specimens. Harry K. Messenger.

Senigaglia, A. The syndrome of Van Der Hoeve with psychopathy. *Riv. Oto-Neuro-Oft.*, 1946, v. 21, May-Aug., pp. 236-244.

A woman 39 years of age with negative family history; had slight depressive psychosis, marked tendency to fractures after slight traumas, deafness which became manifested when she was 30 years of age, and blue scleras. The symptomatology and pathogenesis are discussed. (2 figures, bibliography.)

Melchiorre Lombardo.

Stenstam, Toivo. On the occurrence of keratoconjunctivitis sicca in cases of rheumatoid arthritis. *Acta Med. Scandinav.*, 1947, v. 127, no. 1-2, pp. 130-148.

The material for the study was provided by 495 hospital patients with rheumatoid arthritis ranging from 12 to 55 years of age. Sixty of the 495 cases of arthritis were cases of acute rheumatic fever. Forty-seven of the patients had keratoconjunctivitis sicca. Only one of the 47 occurred in those suffering from rheumatic fever. Because of the joint symptoms these patients attended the rheumatological clinic more frequently than the eye clinic and this fact probably explains the rare occurrence of this eye disease in the out-patient visitors at the eye clinic. Sjogren found one case of keratoconjunctivitis sicca in every 2,000 patients with disease of the eye.

Neurological and clinical studies brought out nothing of importance. Males and females were practically equally affected. The Wassermann reaction was negative in all the patients with keratoconjunctivitis sicca; tuberculin tests were positive in as many cases of arthritis with this disease as without. All these facts make it unlikely that the arthritis and laboratory findings are typical of or are a part of this ocular condition.

Francis M. Crage.

Torres Estrada, Antonio. Keratoplasty relieving blindness of 42 years duration. *Bol. del Hospital Oft. de Ntra. Sra de la Luz*, 1946, Nov.-Dec., and 1947, Jan.-Feb., pp. 245-248.

The right eye, staphylomatous, had been enucleated, and the left eye had been blind for 42 years by reason of a large central leucoma, adherent in the lower part. Optical iridectomy at the 12 o'clock position had produced little improvement. Fortunately the more or less quadrate staphyloma was surrounded by a transparent zone. The keratoplasty was performed on May 20, 1946, using Castroviejo's technique. The continuous suture was removed after 12 days, and the eye was left uncovered after 16 days. The patient was discharged from the hospital after six weeks, with corrected vision of 0.6, and two months later the glasses were changed with further improvement of vision to 0.8. A still further slight change on January 18, 1947, gave vision of 0.9.

W. H. Crisp.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Campos, Raffael. Clinical investigation of colloidometry of the aqueous humor. *Arch. di Ottal.*, 1946, v. 50, Nov.-Dec., pp. 237-255.

The colloidometer of Roenne and the method of using it are described. The clinical histories of seven cases of anterior uveitis are reviewed. Repeated colloidometry reaffirmed the clinical value of these measurements.

Francis P. Guida.

Haefeli, W. The permeability of the blood-aqueous barrier for fluorescein. *Ophthalmologica*, 1946, v. 112; Oct.-Nov., pp. 226-254.

Amsler and Huber (*Ophthalmologica*, 1946, v. 111, p. 156) have devised a simple optical method for the quantitative determination of fluorescein in the aqueous in situ. After the intravenous injection of 2 c.c. of a 10-percent solution of fluorescein sodium, the eye is observed with slitlamp and corneal microscope for the appearance of a green tinge of the aqueous, the intensity of which is measured by dimming, by means of a rheostat, the slitlamp light to the point of disappearance of the green fluorescence. At this extinction point, the intensity of the electric circuit feeding the lamp is inversely proportional to the concentration of fluorescein in the aqueous. With this method the passage of fluorescein into and out of the aqueous has been studied quantitatively on a large number of individuals with normal eyes. The results are presented statistically.

Under the conditions described in the foregoing, fluorescein becomes visible in the aqueous two to four minutes after the injection. The highest fluorescein concentration is reached 25 to 30 minutes after the injection. Children under 15 years of age show increased permeability to fluorescein. Two eyes of the same individual usually behave similarly as far as the passage of fluorescein into and out of the eyes is concerned. After reaching the peak, the fluorescein concentration in the aqueous diminishes very gradually, much more slowly than in the blood. Repeated fluorescein tests on the same individual show very slight variations. In none of the tests on normal eyes was there any optically demonstrable increase in the protein content of the aqueous during the fluorescein experiment.

P. C. Kronfeld.

Mathis, G. Three cases of congenital,

bilateral aniridia. *Rassegna Ital. d'Ottal.*, 1943, v. 12, March-April, p. 133.

The writer reports three cases of aniridia and discusses the principal theories of its etiology and pathogenesis. The patients had defects of the nervous and mental faculties, cranial malformation, ptosis, nystagmus, opacities of the cornea and lenses, and aplasia of the fovea. These findings are held to be evidences of an ectodermal, hereditary dystrophy. Eugene M. Blake.

Newell, Frank W. Extensive traumatic iridodialysis with repair. *Amer. Jour. Ophth.*, 1947, v. 30, June, pp. 695-697. (1 colored plate, 15 references.)

Pignalosa, G. The accommodative power in subjects that have had iridocyclitis. *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 72, June, pp. 321-335. (See Section 3, Physiologic optics, refraction, and color vision.)

8

GLAUCOMA AND OCULAR TENSION

Agundis, Teodulo, Jr. Medical treatment of glaucoma. *Boi. del Hosp. Oft. de Ntra. Sra. de la Luz*, 1946, July-Oct., pp. 200-206.

The subject is dealt with under symptomatology, miotics, derivatives of choline, and osmotic treatment.

W. H. Crisp.

Benner, R. Diathermy puncture of the ciliary body. *Ann. d'Ocul.*, 1947, v. 180, Feb., pp. 89-102.

Based on 44 operations performed on 28 eyes, the detailed results of the diathermic operation of Vogt are tabulated. Approximately 75 percent of

these operations followed other surgical procedures. After conjunctival and retrobulbar anesthesia, and dissection of the conjunctiva and subconjunctiva, 100 to 300 perforating and non-perforating punctures are made in the sclera, 3 to 4 mm. behind the limbus and encircling the globe. These are best accomplished with a shouldered needle 0.5 mm. long, about 0.1 mm. in diameter and with a current of 60 to 80 milliamperes.

The author confirms the experiences of Vogt, Thiel and others that this procedure is best adapted to eyes in which the risks of other surgery are high. It is less applicable to acute and primary glaucomas than to congenital, and glaucomas secondary to iritis, aphakia, and trauma. Sympathetic ophthalmia is a possible complication which the author did not encounter. (7 references.)

Chas. A. Bahn.

Gallois, J. Chronic glaucoma with minimal elective vasodilation. *Ann. d'Ocul.*, 1947, v. 180, Jan., pp. 20-28.

In advanced primary glaucoma capillary degeneration is frequent, both in the eye and other tissues such as the nail bed, and is often accompanied by angiospasm and other disorders of capillary permeability. Ocular hypertension may be the result of vascular noninflammatory malformations such as nevi and arterio-venous aneurysms and of low grade inflammatory and degenerative reactions especially those involving the choroidal veins. Retinal endo- and periphlebitis are not infrequently observed in sections of eyes with primary glaucoma. Stasis, especially in the choroidal veins, frequently complicates bodily atherosclerosis. Stasis in the retinal veins is more passive, but both are aggravated by ar-

terial or capillary compression. Vaso-dilating substances in very small doses tend to reduce venous stasis and thereby potentially reduce intraocular tension. In larger doses they tend to increase intraocular tension. Among the vasodilating drugs thus experimentally used in glaucoma are calcium chloride, magnesium sulphite, nicotinic acid and benzyimidazoline. Based upon an apparently large number of cases and years of study the following test is proposed to determine the advisability of surgical intervention in individual patients with primary glaucoma: 30 mg. of nicotinic acid or 25 mg. of benzyl-imidazoline is slowly injected intravenously, and the tonometric tension is measured every 15 minutes during one hour. No miotic is used before or after the injection. In unfavorable cases which usually include the acute primary and secondary hemorrhagic and long standing degenerating glaucomas, the tension is stationary or somewhat increased, which means that miotic treatment alone will probably not control the ocular hypertension. If the intraocular tension is lowered as it was in 14 of 18 cases observed, the continuance of proper nonsurgical treatment should be considered.

Chas. A. Bahn.

O'Brien, C. S. Surgical treatment of primary glaucoma. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 134-138.

Iridectomy is preferred for the relief of acute block of the anterior chamber in cases of narrow-angle glaucoma. The operation is usually successful if the tension can be reduced to normal with miotics or if the acute attack is not of more than three days duration. An ab externo incision is preferable. Cyclo-

dialysis is most successful in cases of early chronic wide-angle glaucoma and the secondary glaucoma which follows cataract extraction. If almost half the circumference is dialyzed the results are much better. Of the operations which open an extraocular drainage channel, the author prefers the sclerecto-iridectomy of Lagrange. The technique for these operations is described.

John C. Long.

Tiscornia, B. J. Functional exploration of the arterioles, capillaries, and veins of the anterior segment of the eye. *Arch. Chilenos de Oft.*, 1946, v. 2, May-June, pp. 149-156.

The author devotes special attention to the neuroarteriolar test of Vidal and Damel (reduction of ocular tonus after instillation of ephedrine sulphate, 5-percent solution, twenty to sixty minutes); the neurocapillary test of Vidal and Malbran (instillation of a watery solution of chloride of carbaminoylecholine, producing in the normal eye a primary rise of ocular tension, followed by secondary return to normal which is absent in the eye with disturbance of the venous circulation); and the further test of Vidal and Malbran in which instillation of acetylcholine is followed by slight increase of ocular tension. W. H. Crisp.

Torres Estrada, Antonio. Indications for iridectomy in hemicycodialysis. *Bol. del Hosp. Oft. de Ntra. Sra. de la Luz*, 1946, Nov.-Dec., 1947, Jan.-Feb., pp. 237-244.

Iridectomy may be performed prior to the hemicycodialysis, combined with it, or after its execution. The author favors previous iridectomy in all the

congestive forms of the disease, the hemicyclodialysis being performed a few weeks later, when the eye has become quiet. When the two operations are done at the same sitting, iridectomy is done after introducing the spatula, and disinsertion of the ciliary body is the final step. W. H. Crisp.

Weekers, L., and Weekers, R. Technique of nonperforating cyclodiathermy. *Ann. d'Ocul.*, 1947, v. 180, Feb., pp. 76-88.

Diathermy produces uveal vasodilatation, autonomic nervous changes, and specific biochemical actions and thereby potentially reduces ocular hypertension. If properly used, the nonperforating technique is as efficient and far less dangerous than the perforating. The authors prefer a curved electrode with a round tip and an insulated shoulder to facilitate the proper pressure. After local anesthesia, the retrobulbar injection of 4-per cent procaine solution is followed by one c.c. of 40-per cent alcohol. Twelve to 20 applications of 15 seconds' each are made directly on the conjunctiva and encircling the eyeball 7 to 8 mm. posterior to the limbus. The resistance is previously so regulated that the conjunctival temperature is approximately 30° C. at the instant of application and 90° C. in five seconds. The procedure is not painful, no bandage is used postoperatively and only normal salt solution is employed as an irrigating fluid. Hypotension usually begins after a few hours, though occasionally a transient but not important hypertensive phase occurs. The postoperative reaction is usually slight and after a month only a slight focal chorioretinal atrophy exists with pigment dispersion. In one of the cases reported, the

operation was successfully repeated after eight months. This procedure is considered as efficient and less difficult and dangerous than operations whose success depends on opening the eyeball and delicate dissections, especially in the glaucomatous eye. (8 references.) Chas. A. Bahn.

Weekers, R. Incomplete glaucoma. *Ann. d'Ocul.*, 1947, v. 180, Jan., pp. 10-19.

Primary glaucoma is characterized by three cardinal symptoms: ocular hypertension, excavation of the disc, and visual defects, peripheral and central which are correlated with vascular disease in the uvea, the disc and the retina respectively. In primary glaucoma, these three locations are frequently not equally involved and therefore the cardinal symptoms may vary widely. Any one or two of the three cardinal symptoms may indicate an advanced stage when the other symptoms are practically absent. This the author terms incomplete glaucoma, which may be monosymptomatic, or bisymptomatic. One eye may be monosymptomatic and the other bisymptomatic. Monosymptomatic glaucoma may exist for years as such, but usually is an early stage of the bisymptomatic type. The monosymptomatic form includes glaucomatous types of excavation with ocular hypertension of 25 mm. Hg or less and practically no visual defects. Such is the lacunar degeneration of the disc described by Schnabel. Ultimately this type become bisymptomatic. Intraocular hypertension without disc excavation or visual defects is usually the initial stage of the bisymptomatic type. Ocular hypertension alone may exist for a number of years and

does not call for surgical intervention. Ocular hypertension is better tolerated in those with bodily arterial hypertension. Sudden lowering of the arterial hypertension is usually followed by aggravation of the glaucoma. Intraocular hypertension is better tolerated if the minimal arterial retinal tension is elevated. Glaucomas with low ocular tensions but with characteristic campimetric defects are more frequent in those with low retinal arterial tension. The appearance of spontaneous arterial pulsation suggests that the retina is suffering from ischemia. Defective vision with apparently normal ocular tension and disc excavation, but with arciform scotoma may represent the more or less prolonged monsymptomatic stage of an ultimately bisymptomatic glaucoma. In primary glaucoma defective vision is caused by retinal ischemia from arteriolar spasm or from extravascular pressure either in the retina proper or at the disc. Retinal damage caused by the ischemia primarily involves the second and third neurones, with typical defects in the visual fields. Defective vision with characteristic disc excavation may long coexist with ocular tension below 25 mm. Hg. Prolonged defective vision with intraocular hypertension but without characteristic disc excavation is rare. Disc excavation and hypertension without visual defect is relatively frequent, though with very small targets pathologic neuroscotoma may be found.

Chas. A. Bahn.

Weinstein, P. Glaucoma treatment. *Amer. Jour. Ophth.*, 1947, v. 30, June, pp. 755-757. (2 references.)

9

CRYSTALLINE LENS

Gardilic, A. Extraction of the dislocated lens after Jess-Lacarrère. *Oph-*

thalmologica, v. 112, Oct.-Nov., pp. 255-266.

Independently of each other, Jess and Lacarrère devised a method for the extraction of dislocated lense (lying at the bottom of the vitreous) by spearing and lifting them out of the eye with a needle-shaped electrocoagulation electrode.

Gardilic has modified the method as follows. After dissecting a fornix-based conjunctival flap, the incision is started by making a limbic groove into which two corneoscleral sutures of the McLean type are inserted. Through a tiny separate groove at the three-o'clock position in the left eye and nine in the right the needle electrode is introduced into the eye. Guided by the ophthalmoscope, or, in the case of a cloudy vitreous, by a transilluminator applied to the inferior part of the sclera, the electrode is brought in contact with the lens, the needle inserted into it and the coagulating current turned on for two seconds. By careful manipulation of the handle of the electrode, the surgeon makes sure that the lens is following the movements of the needle. The limbic incision is completed with a Graefe knife and extended, with scissors, right up to the previously inserted needle electrode. The lens is extracted by manipulation of the needle electrode and a Weber loop, to depress the posterior wound lip. The author reports one success and one failure.

P. C. Kronfeld.

10

RETINA AND VITREOUS

Duehr, P. A. Some primary considerations in retinal detachment. *Wiconsin M. J.*, 1947, v. 46, May, pp. 515-519.

Some of the cardinal principles of the

CYCLODIALYSIS, MULTIPLE OR SINGLE, WITH AIR INJECTION

AN OPERATIVE TECHNIQUE FOR CHRONIC GLAUCOMA*

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The objective of this procedure is to create a larger dialysis with less trauma than is possible with the ordinary technique of cyclodialysis and to control hemorrhage, thus promoting the formation of a cleft of sufficient size which is permanent. Multiple (or single) cyclodialysis combined with air injection according to the technique described in the following pages has been in my experience a safer and more effective operation than a single cyclodialysis according to the usual method.

The results reported are based on operations performed on 83 eyes. Primary glaucoma was present in 70 eyes; pressure was normalized in 63. In 7 eyes, the results were unsuccessful. Analysis shows that in the eyes afflicted with primary glaucoma, 57 were of the wide-angle type. Tension was normalized in 50 of these, in 41 without the use of miotics; in 9 miotics were required. Of 13 cases of the primary, narrow-angle type of glaucoma with peripheral adhesions (chronic congestive glaucoma), all were normalized; 12 without the use of miotics, and one with miotics.

Of 13 cases of secondary glaucoma, five were normalized without miotics and one with miotics. Seven of these cases

showed unsuccessful results. Since these seven cases were complicated by venous thrombosis, siderosis, cyclitis, and aphakia after unsuccessful trephination, the surgical prognosis would have been extremely poor for any operation.

In judging results, the condition was considered arrested if function was preserved and intraocular pressure remained less than 35 mm. Hg (McLean) for at least one year after the operation. In most of the cases analysed in this report, 3 to 10 years have elapsed since operation. All reported cases were from private practice and were, therefore, well adapted to detailed analysis.

INDICATIONS FOR CYCLODIALYSIS

The effectiveness of cyclodialysis is contingent upon its application to the case in which it is indicated.

It is suggested that the ineffectiveness of present-day operations for chronic glaucoma may be due in some measure to improper choice of the kind of operation to suit the individual case. Improper selection would appear to be due to lack of knowledge of the local mechanical, or the pathologic-anatomic cause of increased pressure in the individual case and to absence of classification of the lesion. Knowledge of these factors would permit a preoperative etiologic differentiation of cases from a surgical point of

* Read at the 75th annual session of the Section on Ophthalmology of the California Medical Association in Los Angeles on May 8, 1946.

view and would facilitate a more rational selection of operation on a causal basis.¹

In previous communications a pathologic-anatomic classification was suggested,^{1,2} in which cases of primary glaucoma were divided into the narrow-angle (or iris-block) and wide-angle types. This has proved a useful guide to the selection of operation and has, in my experience, given better assurance for the effectiveness of the respective operations.

According to this classification, cyclodialysis was used in primary glaucoma in cases of the wide-angle type and in those cases of the narrow-angle type in which a large part of the angle was permanently closed by adhesions. In the wide-angle type, the operation may be used as an alternative to the external filtering operations. In the narrow-angle type, it is suggested that cases presenting peripheral adhesions (late stage of the narrow-angle type, commonly called chronic congestive glaucoma) are particularly amenable to cyclodialysis, since there appears to be little tendency for readherence in the region in which the angle was previously closed by adhesions. For similar reasons it appears that repeated cyclodialysis in the area of a previous cyclodialysis, in which the cleft has become closed by adhesions, is often effective.

A high degree of pressure has not contraindicated the use of this procedure. Although it is assumed that an effort will be made preoperatively to convert a congestive phase into a noncongestive one, congestion does not preclude the operation. The modified procedure of cyclodialysis described in this article appears to be effective under both congestive and noncongestive conditions. Indeed, in cases of the narrow-angle type, in which the angle is closed by adhesions and which are in a highly congestive stage,

cyclodialysis combined with air injection would seem to be the operation of choice to the exclusion of other operations. In this variety and stage of glaucoma, trephination, iridencleisis, and iridectomy are known to be generally ineffective and associated with considerable hazards.

In a series of 13 such eyes operated on according to the technique described, cyclodialysis has been successful in all 13 eyes for periods varying from 1 to 10 years. In one case which had run a congestive course for several weeks with tension of 70 mm. Hg (McLean) both eyes were successfully operated on, and tension was normalized until the death of the patient, 14 months later. Histologic examination showed peripheral synechiae extending throughout the circumference of the angle of both eyes, except in the region of the operation. Here the adhesions had been separated and the angle opened. A cleft leading into the suprachoroidal space was present.*

Cyclodialysis may be indicated in cases in which other operations for glaucoma have failed. In some desperate cases in which the anterior chamber is almost or completely absent, it may be used to advantage combined with iridectomy, according to Wheeler.³ In secondary glaucoma, ophthalmic experience has indicated that cyclodialysis is especially effective in cases of aphakia and luxation of the lens.

Cyclodialysis is relatively contraindicated, in my experience, in cases of primary narrow-angle glaucoma *unless* adhesions have formed in the angle.⁵ When cases of this type have run a noncongestive course, as they often do for many years, they have usually been diagnosed—with cases of the wide-angle type—as chronic simple glaucoma and have con-

* A report of the histologic findings in this case will be published in the near future.

sequently been operated on by cyclodialysis or by an external filtering operation. In narrow-angle glaucoma, however, the crowded anatomic conditions in the angle and the relatively increased vitreous pressure, which tends to propel parts forward and to press the ciliary body against its base, encourages closure of the cleft made by the cyclodialysis. On the basis of clinical experience and post-operative gonioscopic studies, iridectomy⁴ (in modified form) appears to give better results. It has been effective in the large majority of cases presenting the narrow-angle type of glaucoma before adhesions have formed in the angle.

SUMMARY

Cyclodialysis combined with air injection is indicated in primary glaucoma of the wide-angle type. It appears to be the operation of choice in cases of narrow-angle glaucoma with peripheral adhesions and in certain varieties of secondary glaucoma. It may be used to advantage on eyes in which other glaucoma operations have failed.

ACTION OF CYCLODIALYSIS

Gonioscopic studies^{5, 6} have shown that the successful action of cyclodialysis depends upon the formation of a permanent separation or cleft between the ciliary body and its attachment. This is confirmed by the histologic findings in a single case of Elschsig,⁷ and in two eyes in the present series which were successfully dialysed and came to section one year after operation. The role of the cleft formation has been confirmed by Clarke,⁸ Sugar,⁹ and others.

It is assumed that the aqueous passes through the cyclodialysis cleft into the suprachoroidal space where it is absorbed. The assumption is confirmed clinically by several cases in this series, in which an acute rise in pressure fol-

lowed a gonioscopically demonstrable, sudden closure of the cleft several years after the operation. Reopening of the cleft by miotics resulted in a sudden drop of pressure to the previous normal.

Gradual closure of the cleft, which has been the cause of the frequent lack of permanent results of cyclodialysis, is shown by gonioscopic studies⁵ to be due to: (1) Insufficient extent of the original dialysis. (2) Operative trauma in the region of the cleft, which causes adhesions. (3) Hemorrhage into the anterior chamber (at the time of operation or during the first week of convalescence) which promotes readherence of the ciliary body. Hemorrhage has been a common clinical experience, and its influence on closure of the cleft is well known. A direct relationship may be remarked between hemorrhage into the anterior chamber and readherence of the iris root, not only by its incidence but also by actual observation in the individual case of the process of readherence along the line of the organizing blood clot.

AIR INJECTION IN CYCLODIALYSIS

In 1938, the writer injected air into the sealed anterior chamber with the intention of deepening it and widening the cleft by pushing the iris posteriorly. Immediately following injection, a slight hemorrhage into the chamber, such as commonly occurs in cyclodialysis, was seen to stop. After evacuation of the air from the chamber, no further bleeding occurred.

Furthermore, it was observed that the chamber angle had become image forming, evidently due to the different refractive index of air from aqueous. As a result, the cleft and its widening could be seen by direct observation without the use of a prismatic contact glass; the size or sufficiency of the cleft could often be determined at the time of operation.

The observations made at that time indicated that air injection might become a valuable aid in stopping and in preventing hemorrhage during cyclodialysis; that it might help in determining the sufficiency of the cleft immediately subsequent to operation; and finally that it might be used to maintain the patency of the cleft.

It was next observed, in some cases, that after several minutes and under certain conditions, there developed a progressive rise in intraocular pressure, evidently as the result of air blocking the free circulation of aqueous, thus producing a secondary glaucoma. When this condition occurred, there was a sufficient quantity of air under pressure to produce seclusion of the pupil, which in some cases was combined with obstruction of the angle. In view of this danger, it became evident that only a limited quantity of air could be allowed to remain post-operatively in the anterior chamber to maintain the cleft opening. Further observations on this subject will be published in a succeeding paper.

Various developments and experiences with air injection in a series of over 83 eyes operated on by cyclodialysis since 1938 have confirmed these observations. Air injection has consistently proved effective in stopping and in preventing hemorrhage in all cases of cyclodialysis in which it has been promptly used.*

In the procedure of air injection for single and multiple cyclodialysis, air, followed by physiologic saline solution if desired, is injected into the sealed anterior chamber. Both the scleral incision for the injection of air and the corneal puncture for the injection of saline are made in an oblique direction in order that they may act as valve or trap-door aper-

tures, which permit ingress but prevent egress of air or fluid except when this is desired. The anterior chamber is thus air and watertight as regards its contents.

The anterior chamber need not necessarily be completely filled with air. A bubble of air, which does not entirely fill the chamber and does not increase the pressure, will act as an adequate cushion to prevent excessive hemorrhage, keep the cleft free of blood, and, perhaps, help by its presence to keep the opposing surfaces apart in many cases. In cases in which hemorrhage threatens, however, it appears advisable to inject air under pressure, thus filling the entire chamber.

The amount of air pressure exerted on the inner walls of the anterior chamber can be controlled according to need. The air may be regarded as an adjustable internal tourniquet. After a few minutes of increased air pressure, when the danger of hemorrhage is past, a part of the air may be allowed to escape through an oblique puncture incision made in the cornea with a Graefe knife, in order to obtain a valve closure; or the air released may be replaced if desired by physiologic saline solution under pressure. When saline solution is used, the increased intraocular pressure returns to normal within 5 to 10 minutes. Evidently the excess solution is carried off through the physiologic channels of outflow and possibly also through the cyclodialysis cleft.

Air injected into the anterior chamber prevents primary hemorrhage during and immediately following operation by raising intraocular pressure. The presence of air and saline solution in the anterior chamber also neutralizes the suction action of the cornea which might, otherwise, encourage bleeding into the chamber. Later when the excess air is removed, the substitution of physiologic saline solution prevents secondary hem-

* The hemostatic action of air injected during cyclodialysis has recently been noted by Randolph.¹⁰

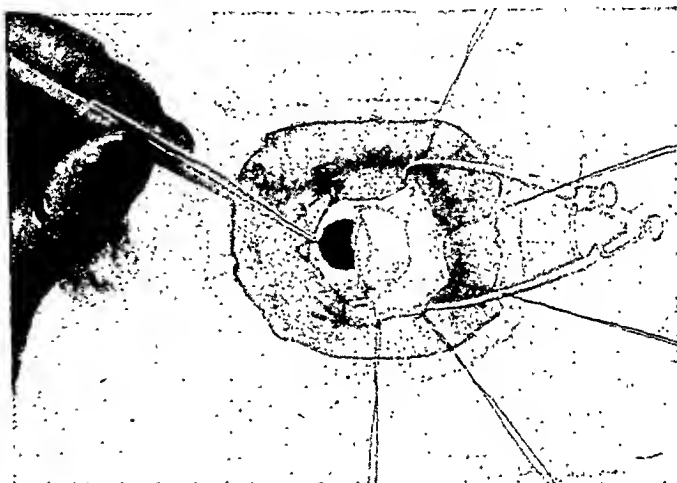
orrhage into the retina or vitreous, such as is caused occasionally by too sudden a reduction of pressure following cyclodialysis in elderly patients with sclerotic blood vessels. It does not, however, appear to discourage the late secondary hemorrhages into the anterior chamber which may occur during the first week following operation.

MULTIPLE CYCLODIALYSIS

Restoration of the anterior chamber by air injection immediately following a cyclodialysis makes it possible to perform

posure of the sclera in both upper and lower quadrants, a tightly wound applicator which has been dipped in adrenalin (1:1,000) may be pressed against the areas of the sclera in which the incisions are to be made. Episcleral vessels may be obliterated by cauterization with the end of a strabismus hook which has been heated in an alcohol flame. The posterior conjunctival flap is retracted by means of six 5-0, atraumatic, single-armed sutures of black silk which are attached under some tension to the face mask by means of hemostatic forceps.

Fig. 1 (Barkan), A curved conjunctival flap, 10 mm. in length, is formed extending from the 6- to 12-o'clock positions. The posterior flap is retracted by means of six 5-0, atraumatic, single-armed sutures of black silk which are attached under some tension to the face mask by means of hemostatic forceps.



a second cyclodialysis. By creating two moderate-sized dialyses at the same sitting, it is possible to obtain more consistently an adequate separation of the iris root with less trauma than by a single large dialysis. It is also possible to avoid major blood vessels which are situated in the horizontal meridian.

TECHNIQUE

Preoperatively, extreme miosis should be achieved. Anesthesia may be local or general. The usual injections preliminary to local anesthesia are carried out. A curved conjunctival flap, 10 mm. in length, is formed extending from the 6- to 12-o'clock positions (fig. 1). After ex-

The operative area is thus exposed, while the outer portions of the lids and the outer canthus are covered by the conjunctival flap whose raw surface is pointing upward, thereby rendering the area and its surroundings aseptic. The globe is fixed at the insertion of the lateral rectus with a fine-toothed forceps. The scleral incision is made with a sharp keratome in the lower outer quadrant, 8 mm. posterior to the corneoscleral border and oblique to the surface of the sclera (fig. 2).

After the initial incision is made, it is sometimes more convenient to grasp the scleral wound lip itself. The incision is carried through the sclera by successive

light strokes of the keratome and is slowly deepened until the lack of resistance indicates that the sclera has been perforated, due care being taken not to incise the underlying choroid. At this point, an iris spatula, 3 mm. in width, is introduced into the incision in order to test its patency and to determine if it is of sufficient length to facilitate later air injection (fig. 3). The incision can be made longer.

A second incision is now made in the upper outer quadrant in the same man-

globe is fixed by the assistant throughout the performance of the cyclodialysis and other maneuvers involving air or saline injections.

Before beginning the cyclodialysis, the surgeon makes certain that four 5-cc. Luer syringes, with No. 23 B-D. gold cannulas attached, are filled with air which has been sterilized by pulling it through a flame or through cotton wool, and are in readiness. I have found that one accomplishes air injection under pressure more easily and more consist-

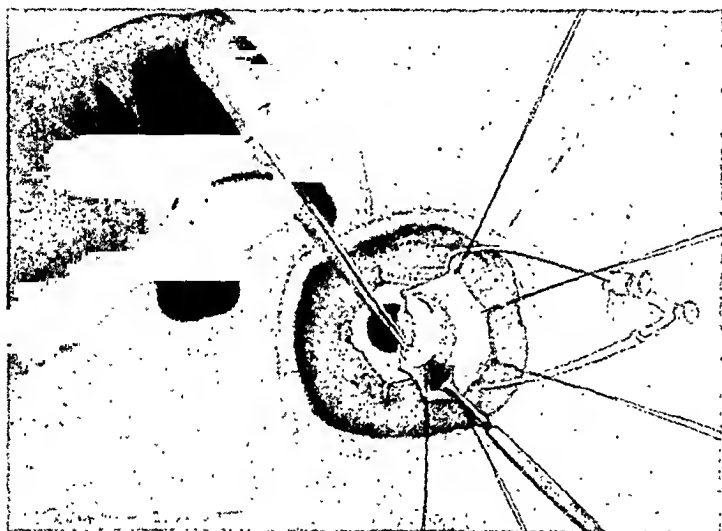


Fig. 2 (Barkan). The scleral incision is made with a sharp keratome in the lower outer quadrant, 8 mm. posterior to the corneoscleral border and oblique to the surface of the sclera.

ner. However, care must be taken to make this incision more obliquely than in the lower quadrant, because the sclera is often found to be thinner in the upper than it is in the lower quadrant. This is especially true in primary wide-angle glaucoma, in many cases of which a darkish hue found in the upper quadrant is caused by the uvea shimmering through the sclera which may be of almost paperlike thinness, even though the pressure is not markedly elevated. This incision is likewise tested for its length, another 3-mm.-wide spatula being used.

An assistant now firmly grasps the globe at the contralateral limbus with an Elschnig or Gifford lock forceps. The

ently with a 5-cc. syringe than with a smaller syringe. A syringe is now held by the instrument nurse or by the assistant with his free hand, two inches from the surgeon's hand, in such a position that during the performance of cyclodialysis the direction of the cannula corresponds to the meridian of the globe into which it is to be inserted—the same meridian in which the spatula was inserted. The surgeon now fixes the globe at the insertion of the external rectus tendon while he performs a cyclodialysis with a spatula, 2-mm. wide, that has been appropriately bent. One to 2 mm. of the blade of the spatula appears within the anterior chamber. The handle is rotated in

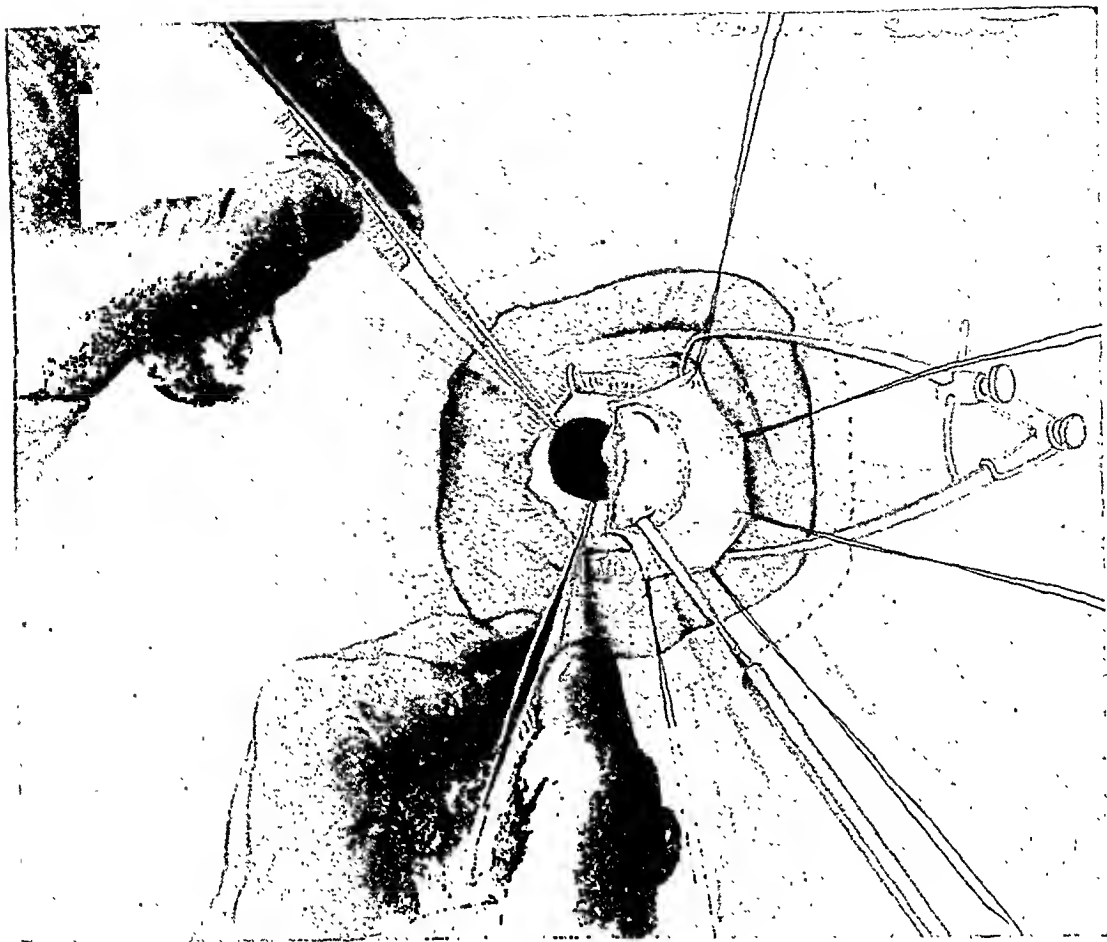


Fig. 3 (Barkan). An iris spatula, 3 mm. in width, is introduced into the incision in order to test its patency and to determine whether it is of sufficient length to facilitate later air injection.

such a manner that the tip of the spatula moves vertically to just short of the horizontal meridian. It is well to undermine for 3 mm. posteriorly to the corneoscleral border at either end of the sweep and to avoid crossing the horizontal meridian where major blood vessels are located. This maneuver should be followed without loss of a moment by the air injection which has been made ready.

At the moment the surgeon removes the spatula, the syringe with gold cannula held in proper position is placed in his two hands without his having to look up. He inserts it into the incision from which he has just removed the spatula and immediately injects the air into the anterior chamber (fig. 4). This maneuver should

take only a fraction of a second. The quantity of air to be injected in each individual case and whether the air should be under pressure or not are matters of experience and judgment. The chamber is thus restored with air. After waiting a few minutes to allow hemostatic action to take place, a second cyclodialysis is undertaken in a similar manner.

The air lost during performance of the second cyclodialysis is replaced with another injection of air that again restores the chamber and stops hemorrhage. Since, due to the presence of air, the angle has now become image forming, the surgeon may inspect the region of the cyclodialysis by looking across the chamber from the opposite side. If the

cleft is judged inadequate, the cyclodialysis may be enlarged with another spatula, and the air injection repeated.

After a few minutes, when danger of hemorrhage is past, a part of the air may be allowed to escape through a corneal puncture. In order to obtain valve closure this puncture is placed obliquely with a Graefe knife, 1 mm. axially to the corneoscleral border. If preferred, the air may be replaced by physiologic saline solution* injected with a No.-30 needle. This puncture is made sufficiently oblique to assure a valve or trap-door closure. The point of the knife should barely perforate Descemet's membrane, as observed under a binocular loupe. A small air bubble (4 to 5 mm. in diameter) is allowed to remain. When combined with appropriate positioning of the head, it

ating small amounts as indicated. After closure of the conjunctival wound, this

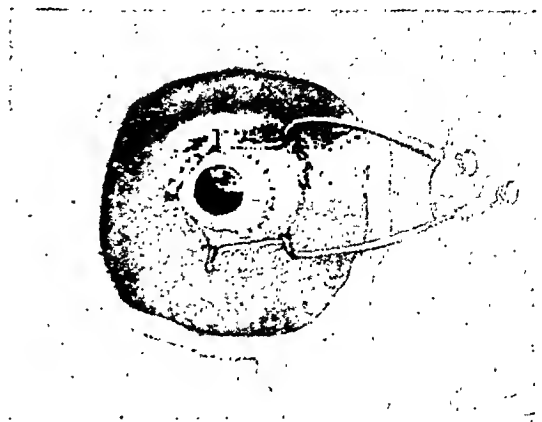


Fig. 5 (Barkan). The air bubble is placed in the region of the cyclodialysis by appropriate positioning of the head.

process is controlled by testing with a tonometer, the base of which has been

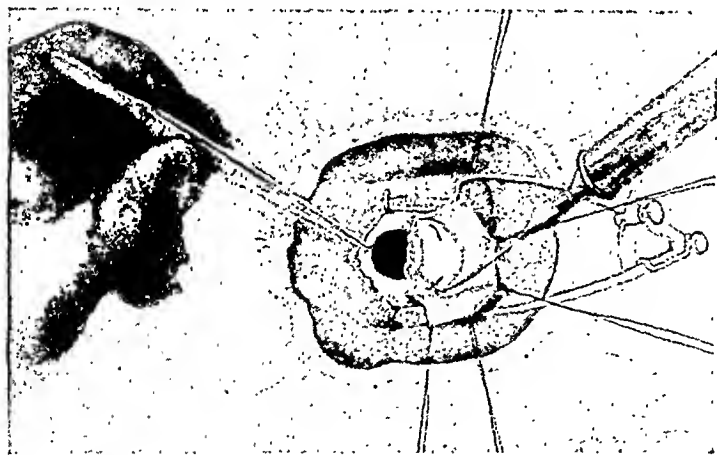


Fig. 4 (Barkan). Following removal of the spatula, the cannula is inserted into the incision, and air is injected into the anterior chamber. This maneuver should take only a fraction of a second.

will keep the cleft free from blood and help to keep the surfaces apart (fig. 5).

Successful insufflation of the anterior chamber with air is assured by continuing to inject air during removal of the cannula. If the injection of air is stopped prior to removal of the cannula, air will escape during the removal.

The entire chamber may be filled with air, the pressure being adjusted by the amount injected or by secondarily evacu-

sterilized with alcohol and which is held in a sterile clamp, or by testing the dimpling of the cornea with a glass rod.

During the first few days of postoperative care, the patient's head should be kept rotated to the opposite side and raised so that the air bubble will take its position in the chamber angle at the location of the upper cleft. If the patient lies on his unoperated side and is as flat as is compatible with comfort, any slight hemorrhage will gravitate to the lower nasal side away from both clefts. If only

* Because it is to be injected into the anterior chamber, solution from ampules is used.

a single cyclodialysis has been made in the upper outer quadrant, the patient may assume a semisitting position with the head rotated to the opposite side. How effective the presence of air is in widening the cleft and keeping it apart is, as yet, an open question which only further observations can decide. In some cases, the air bubble has appeared to maintain the separation during the first few days of healing.

POSTOPERATIVE PROPHYLAXIS

During the convalescence, maximal miosis should be maintained in order to pull the root of the iris from its base and keep the cleft open. For this purpose, 5-percent prostigmin is instilled, and it may be necessary in some cases to use it as frequently as every three hours and to support its action by the use of a 1-percent eserine ointment. Since there is a marked tendency to formation of pigment adhesions in the pupillary area following cyclodialysis, one drop of adrenalin (1:100) should be instilled, combined with one drop of euphthalmine (2 percent) when deemed necessary during the first several days of postoperative care to prevent the formation of pupillary adhesions of the pigment layer of the iris while the pupil is in miosis. When this is done, the eye must be kept under strict observation and the dilatation of the pupil be only temporary.

As soon as a moderate dilatation of 3 to 4 mm. has been accomplished, the pupil should immediately be contracted again, lest mydriasis encourage closure of the cleft by approximating the root of the iris to its base. This is especially true if it has been necessary to operate with cyclodialysis on a case of glaucoma of the narrow-angle type, or if, in a case of the wide-angle type, the angle is fortuitously narrow.

That the maintenance of miosis is an

effective factor in keeping the cleft from closing was suggested by my experience in several cases of cyclodialysis in which a rapid and sudden rise in pressure occurred several months or years after operation. In the case of an aphakic eye with a very extensive cleft, this occurred after normal pressure had been maintained for eight years without miotics. Since pressure dropped suddenly following contraction of the pupil with miotics and subsequent gonioscopic examination revealed an open cleft, the increased pressure in this case was evidently due to closure of the cleft. I have, therefore, come to the conclusion, which I have carried out in practice, that all successfully dialyzed eyes, even though the cleft be gonioscopically wide and extensive, should continue to be given miotics prophylactically once or twice a day—*not with the purpose of reducing pressure but in order to keep the cleft open.*

There are disadvantages associated with the operation of cyclodialysis. Among these are the secondary hemorrhages that occur during convalescence. In only one case, however, have they interfered with the result. Another disadvantage is the formation of pigment synechiae. This can be prevented in most cases by following the treatment outlined earlier in this paper. There has been no case of iritis or sympathetic ophthalmia.

Formation of cataract or hastening of the development of incipient cataractous changes appears to be the main disadvantage of the operation. This is especially true in those cases in which pressure is reduced to a low normal or below the usual normal limits. Of 70 cases of primary glaucoma, 15 developed cataracts. Ten of these cataracts have been extracted, all with good results. Cataractous changes already present before operation in 16 other cases have increased.

As Reese¹¹ states "eyes with primary glaucoma are more predisposed to the

development of cataract than nonglaucomatous eyes. One third or more of the eyes with primary glaucoma have incipient cataractous changes. Operations for glaucoma in general, and especially the trephine operation, tend to hasten the development of these incipient cataractous changes." Although this statement also applies to cyclodialysis, it should not interfere with the decision to perform this operation in cases of primary, narrow-angle glaucoma with peripheral adhesions, in aphakia, or in subluxation of the lens. In all of these conditions, cyclodialysis possesses marked advantages over other operations for glaucoma.

SUMMARY AND CONCLUSIONS

1. The procedure for cyclodialysis—multiple or single—combined with air injection is described.

2. Air injection controls hemorrhage, widens the cyclodialysis cleft, makes the cleft visible, and, by restoring and deepening the anterior chamber, makes possible a multiple cyclodialysis.

3. Multiple cyclodialysis with air injection is safer and more effective than a large single cyclodialysis performed according to the usual method. By employing multiple cyclodialysis, it is possible to make a permanent dialysis more consistently, with less trauma and without hemorrhage, and to promote, under visual control, the formation of a permanent cleft of sufficient size.

4. Under certain conditions, continuance of air pressure in the anterior chamber produces obstruction, retention, and thus artificial glaucoma.

5. Cyclodialysis combined with air injection is indicated in primary glaucoma of the wide-angle type. It is especially indicated, to the exclusion of trephination, iridencleisis, and iridectomy, in the late stage of the narrow-angle type after peripheral adhesions have closed the angle

in large part, irrespective of whether there is congestion or not. It is indicated in those varieties of secondary glaucoma for which cyclodialysis is the commonly accepted operation.

6. The operative procedure consists of the following steps:

- a. Preoperatively, extreme miosis should be achieved.
- b. Following the cyclodialysis, air is injected.
- c. The second cyclodialysis is made through a scleral incision in the adjoining quadrant.
- d. Following the second cyclodialysis, air is again injected. The cleft is examined by visual control and, if deemed necessary, it can be enlarged and the air injection repeated.
- e. Hemorrhage having been prevented, air is replaced after a few minutes by physiologic saline solution, if it is desired.
- f. A small air bubble is left in the chamber to promote separation of the cleft and to keep it free from blood.
- g. Prostigmin (5 percent) is instilled postoperatively to maintain maximal miosis. Postoperative maintenance of miosis is an effective factor in keeping the cleft and the channel of outlet from closing.
- h. Adrenalin (1:100) and euphthalmine (2 percent) should be instilled at intervals of a few days to prevent formation of pupillary adhesions. Mydriasis must be transient only, and must be adequately counteracted by miotics.

7. A miotic should be used once or twice daily permanently as a prophylactic to assure maintenance of the cleft and channel.

490 Post Street (2).

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OPHTHALMOLOGY DURING THE WAR AND IN THE FUTURE*

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It is indeed with the greatest diffidence that I am presenting you with this paper. I am profoundly aware of the honor which your Society has done me at this time, and I feel, as is perhaps natural, that the least I should be able to do in reply is to attempt to return the compliment by making this the occasion of a great effort on my part to present something really new and striking to you.

Such, alas, is not to be; for new conceptions do not come lightly but only after much work and thought, and the years which have just passed have been years of destruction rather than of construction. For six of them I have been away from my clinics and my laboratories, and, apart from enrichment from

many types of experience—not the least of which was meeting large numbers of friends and colleagues from this side of the Atlantic in many parts of the world—on the whole, the content of these years must be added to the mountain of waste which seems always to be characteristic of war. And so I have come to you empty-handed, with little more than apologies. But, knowing you, I have little fear that these apologies will readily be accepted.

Having nothing new to offer you, I hope you will not think it out of place if I spend a little time considering what ophthalmology has done in the war in the clinical sense—not in the technical sense—and what we may hope it will do in the immediate years to come.

Looking back, it seems to me extraordinary how few are the surgical advances that have arisen directly out of the war. One always associates the ex-

* Read at the 82nd annual meeting of the American Ophthalmological Society at San Francisco, California, June, 1946.

periences of war with its mass mutilation and its herding together of great numbers of people in artificial circumstances and its consequent opportunities for large-scale coördinated investigations and controlled experiment, with considerable advances in the science of medicine and the technique of surgery.

The advances in general surgery in the first World War were great. In ophthalmology during these years, to quote two instances, our technique in dealing with intraocular foreign bodies was revolutionized and our conceptions of the minute central localization of the visual functions were for the first time put on a secure observational basis.

In this war, fundamental progress in surgery has been less striking. It is true that there have been innovations in surgical technique, but most of them have been incidental and detailed, and even the holocaust of intraocular foreign bodies with which we were inundated in the field and at home through bombing has left the position relatively unchanged. It is also true that new ideas such as the ingenious Berman locator have been elaborated, and that methods, some of them more ingenious than safe, have been suggested for the extraction of nonmagnetizable foreign bodies.

Novel and probably fruitful suggestions have also been made in the fitting of artificial eyes. But in the main these, and other surgical innovations, are incidental refinements of already accepted principles. There has been nothing completely new of first-class importance and revolutionary scope such as the introduction in the previous decade of operations for the reposition of retinal detachments or the popularization of the technique of corneal grafting.

ADVANCES IN CHEMOTHERAPY

In ophthalmic medicine the greatest

advance has, of course, been made in chemotherapy. The original sulfonamides introduced before the war have benefited by mass application and intensive study, and their place in ophthalmology—a very useful one—has now become firmly established. Newer compounds, improving on the old by increased effectivity and decreased toxicity, have followed each other in rapid succession. Furthermore, the magic of penicillin, locked up in obscurity in a laboratory in London for more than a decade, has been exploited and has produced revolutionary results quite unequalled in its field in ophthalmic history. It must be admitted that neither of these advances was primarily ophthalmological; but we can claim that ophthalmology has not been behindhand in their exploitation.

It is probably the case that most ocular inflammations are not infective but rather allergic or reactive, corresponding in a sense to the so-called rheumatic inflammations of synovial membranes, and, therefore, the bacteriostatic drugs are less applicable to our specialty than many other parts of the body. But the advances of the last 10 years whereby many organismal intraocular infections can be aborted or controlled by the sulfa drugs, and more extraocular infections can be still more dramatically overwhelmed by penicillin—when, for example, gonococcal conjunctivitis can be cured in fewer hours than it took weeks in a previous generation—are indeed remarkable.

It is true that Florey would have abstracted penicillin from Fleming's laboratory if there had been no war; but without the war to stir our two governments from their customary lethargy toward medical progress to throw all their resources into the fullest and most rapid exploitation of these drugs, we would, I am sure, be much further behind than we are today in our therapeutics.

PHYSIOLOGY OF VISION

PRACTICAL APPLICATIONS

As a direct result of the war most work—at any rate in my personal experience—has concerned itself with the practical applications of the physiology of vision. Most of the work on which large numbers of people in both our countries were employed was very specialized and much of it has not been published. At any rate, my knowledge of the optics of gunsights, range-finders, periscopes in tanks, graticules in telescopes, viewing and scanning devices, the lighting of instrument panels, dials and controls, the uses of goggles, problems of dazzle, scatter and haze, and, above all, of night vision and dark adaptation has increased beyond all bounds. But most of this has been the meticulous application of the detail of principles already known to a type of practice which demanded the utmost refinement of exactitude.

Two real advances have been made—or rather have been begun—both of which may yield results of great practical and constructive value: the study of the performance of the eye at high altitudes, and the study of the scotopic or rod fields. It is an extraordinary thing that all the work done upon the visual fields—and it has been great in volume and in achievement—has been upon the daylight field of the photopic eye. Only recently, so far as I know, since it was started by Livingston in London, has the rod field of the dark-adapted eye been investigated with some of its vagaries in pathologic states. Although the technique is laborious and time-consuming, the further exploitation of this may lead to results in clinical ophthalmology of more than usual interest.

FUNDAMENTAL ASPECTS

On the more fundamental aspects of

the physiology of vision, however, I think we are on the threshold of a big and exciting revolution in thought—despite, and not because of, the war.

On the photochemistry of vision and the role of visual purple and its relationship to vitamin A, our knowledge is becoming much more precise. In this connection the outstanding work of Selig Hecht in New York and George Wall at Harvard must receive very special mention. Our knowledge of the photochemistry of the cones is just beginning.

What is more intriguing, studies in dark adaptation—particularly those conducted in London by Lythgoe whose early death is a great tragedy for this branch of our subject—are beginning to show that the mechanism of adaptation is not entirely chemical, but that a nervous mechanism comes into play as well. Possibly there is a rearrangement of the inter-retinal synapses by which there develops a decreasing ability to perform the finer visual judgements and at the same time an increasing ability to initiate a cruder impulse on minimal stimulation.

This brings us at once to the monumental histologic research of Polyak in Chicago on the inter-retinal association and integrating systems. It is curious that since the early work on the intimate anatomy of the retina conducted about the middle of the last century by such investigators as Müller, Schultze, and Schwalbe which culminated about the end of the century in the classical researches of Ramon y Cajal, little or no investigation has been undertaken, and it is difficult to realize that the numerous schematic diagrams of the intimate morphology of this tissue that appear so established in our textbooks, all of them copied from Cajal's work, are based more upon speculation than upon established neurohistologic fact.

Our classical conception of the struc-

ture of the retina is insufficient to explain many phenomena of vision related to visual acuity, color vision, sensory gradients, the interrelation of retinal areas, and so on. Histology has remained very far behind the advances in the physiology of vision. Some of Polyak's theoretical deductions from his studies may be open to question, but there can be no doubt that the possibilities of an anatomic groundwork for integration and association, as well as of inhibition in the photoreceptive apparatus, are full of promise and must be explored further.

ELECTROPHYSIOLOGY

In the meantime further—and, to my mind, still more fascinating—evidence has come from another quarter—electrophysiology with the use of the microelectrode technique whereby the impulses of single nerve fibers are picked up and analyzed, work commenced by Adrian in Cambridge and continued by Granit in Stockholm.

This microelectrode technique which picks up and amplifies changes in potential of a single fiber in the optic nerve when a cone or rod is stimulated by light is a beautiful procedure, demanding great skill and aptitude on the part of the experimenter. It has brought to light results of exceptional interest.

When the response-curves are assorted into groups, eight separate types are found in most animals. The first type, which has a broad response-curve, is stimulated by nearly all parts of the spectrum. This Granit calls a "dominator." The remaining seven types, all of which have a narrow response, are stimulated by one part of the spectrum only. These Granit calls "modulators."

This discovery does not seem very hopeful for the survival of the trichromatic theory of vision; a polychromatic theory would appear to be indicated. The results so far have been obtained only on experimental animals, but it is prob-

able that similar results would be obtained on man, a question the testing of which is now being investigated.

Other physiologic observations recently made are disturbing for the old hypothesis of Thomas Young, according to which certain cones respond to red, others to green, and others to blue light—the establishment by Shlpear in America and Hartridge in London, for example, that the acuity of the eye in colored light was identical with that in white of equal intensity. Equally interesting is the demonstration that the spurious colors of the chromatic aberration of the eye are not neutralized physically but are eliminated by a nervous response.

There is little doubt, I think, that with the elaboration of microtechniques applied to the visual system and the facilities offered by the new electrophysics which gave us radar, great advances are due in our knowledge of the mechanism of photoreception whereby it is possible that many of our old ideas, accepted so long that their status as hypotheses has almost been forgotten, will require drastic revision.

When the same process is carried further into the central nervous system after the manner of Talbot and his co-workers in Baltimore, there is no knowing where we shall end. The next 10 years promise plenty of excitement, and I would like nothing better than to pass them with a microelectrode.

VEGETATIVE PHYSIOLOGY

Let us turn to what I like to call the vegetative physiology of the eye. Here I think developments no less exciting are impending. Let us look at the most fundamental problem in this branch of our subject—the formation and the elimination of the intraocular fluid and the control of the ocular tension.

When at the end of the last century Leber brought forward his theory of the transudation of the intraocular fluid from

the ciliary capillaries and its drainage through the canal of Schlemm, it seemed for a long time as if the last word had been said upon the subject.

The advances of physicochemistry in the first quarter of this century revealed that this hypothesis was inadequate, and in the later twenties I elaborated the theory that the aqueous was a dialysate of the blood in physicochemical equilibrium with it and that superimposed on this dialysation was a secondary circulation determined by pressure differences.

Now, in the forties, history is repeating itself. While to the relatively crude experimental methods which were at my disposal 20 years ago the postulates of dialysation seemed fully satisfied, the finer and more accurate methods of today have shown them to be insufficient. During the last 12 years, Jonas Friedenwald in Baltimore, in a prolonged series of brilliant and sustained researches (whose value I appreciate most highly), has been attacking the hypothesis of dialysation. From Philadelphia Francis Adler, in a quieter way, has been doing much the same thing. And, just recently, typically without any warning, David Cogan and Kinsey have thrown an atom bomb into the arena, and, using heavy water and radioactive elements from the cyclotron at Harvard, have shown that we all will need to start to think again.

Twenty years ago, in the arrogance of youth, I thought I had found the last word. Today, as I grow old, I also grow modest. But still I think I am fundamentally correct in the view that the aqueous is essentially a dialysate, although its constitution is almost certainly modified by the interposition of a membrane or membranes, of which we know little, between the blood and the chambers of the eye, and certainly is modified by metabolic processes within the eye.

Lest Friedenwald may think that some of the excitements of battle have gone out of his life, I would suggest that some

of his work may bear alternative explanations. I do not think his demonstration of the unidirectional permeability of the ciliary epithelium to water is wholly convincing; I do not agree that the irreciprocal permeability of the ciliary epithelium to acid and basic dyes—which he has demonstrated most beautifully—implies a similar permeability to all ions: in fact, just before the war, I satisfied myself that it was not so.

If the penetration of dyes is to be relied upon as an index of a secretory activity, then we must endow, for example, the membrane of the red blood cell with secretory activity. Friedenwald's demonstration of an oxidation-reduction system based on vitamin C in the ciliary stroma is a beautiful piece of work, and his finding that diminution of the vitamin impairs the formation of the plasmod aqueous formed after paracentesis would suggest that it has considerable significance; but what that significance is I do not know.

It is conceivable, for example, that it may be associated with the capillary endothelium, in the vitality of which there is some evidence that the oxidative vitamins of the B group are intimately concerned. At any rate in the next 10 years it is to be a great adventure to try to find out. My next 10 years, you will observe, are to be fully occupied; for the spare time left over from the microelectrode should be spent spiritually between the Wilmer Institute and the cyclotron at Harvard.

PHYSIOLOGY OF THE CORNEA

About the vitreous there is little fundamentally new, but, with the electron microscope and radioactive tracer elements at our disposal, there is the prospect of further advances in our knowledge of its structure and metabolism.

To a considerable extent the cornea has come to life again. Leber in 1873 advanced his theories on the lymph cir-

culatation in this tissue, and there our knowledge remained substantially until the studies of Fischer in 1928 elucidated its respiratory mechanism. Recently Cogan and Kinsey have taken up the subject and have suggested in a very conclusive way a new mechanism for the fluid-traffic of this tissue.

This opens up a new approach to the physiology of the cornea, about which we know so little. Even about its autoxidation mechanisms we know nothing. It always strikes me as peculiar that we know so little about the pathology of the cornea for it is a transparent tissue, exceedingly accessible and relatively isolated. It was used by the early pathologists in the middle of the last century to appreciate the general changes characteristic of inflammation, and since their relatively crude observations little more has been added.

It has always been a disappointment to me that the great amount of time that so many of us have expended on the study of the action of the war gases on this tissue was so dominated by the immediate emergency and led to no more fruitful results. It seems not without the bounds of possibility, however, to suggest that, with all the refinements of technique available today, the intensive and intimate study of this tissue in disease might not only add to our local knowledge but also provide the groundwork for further advances in the fundamentals of the pathology of inflammation generally.

PHYSIOLOGY OF THE LENS

So, too, with the lens. Our knowledge of this tissue, particularly of its respiratory mechanism and the essential part played therein by the vitamins of the B and C groups, is increasing rapidly—work of great interest wherewith the name of Bellows of Chicago is closely associated.

Here again we have a system unique in the body, readily seen, easily manipulated, and perfectly isolated for experimental purposes whose continued health seems dependent essentially on the integrity of its intracellular oxidative systems. I do not think it is too much to expect that in the next 10 years, given sufficient enthusiasm, not only may some of the problems of cataract disappear but valuable pointers may be provided for the understanding of the general problems of sclerosis and senility wherein an oxidative failure of the same type is probably a crucial factor.

EVALUATION OF EXPERIMENTAL OPPORTUNITIES

COMPLETE REVOLUTION IN METHODS

It would seem that the program for the next 10 years is very heavily booked up. I may speak hopefully, but I do not think I am expecting too much. For now we have available to us a complete revolution in methods.

I am not suggesting that the classical modes of inquiry by clinical examination and cellular pathology are outmoded or have yielded their full harvest, but there seems little prospect of further revolutionary advances with their aid.

Recently it has become possible to change our method of inquiry. Instead of busying ourselves with the structural ruins which disease has left behind it, as is the province of pathology, we are now able to probe more deeply and examine the more subtle nature of the initial defect, to pass from the study of structures composed of cells to the study of cells composed of molecules and atoms.

Now, equipped with techniques whereby micro-analyses of a minute drop can be undertaken more accurately than the gross analyses of a generation ago, whereby it is easy to estimate the pH of a single cell or pick up and analyze the

action current in a single nerve fiber excited by a single band of wave lengths, when we look not with microscopic or even ultramicroscopic eyes but with electron microscopes whereby viruses can be seen rather than believed and a single cell is too gross an object for adequate study, when we can follow metabolic processes with labeled elements throughout all the intricacies of metabolism—with all this equipment opening up all these new worlds, we should make great strides.

Some months ago I read in one of our more inaccurate newspapers—we have this kind of newspaper in my country as well as yours—that the discovery of carbon 13 would shortly revolutionize medicine and yield up the secret of life itself. The reporter did not know that at the time he wrote carbon 13 was already old-fashioned; but the fact remains that this may be an overstatement and it may well not. But, whether it is or not, no one can complain of the variety and scope of the opportunities that are offering themselves, or of the difficulty, the complexity, and the interest of the problems facing us.

There is another very important matter. The older methods were observational only: the newer ones can make fuller use of the experimental method. They can take nature and, so to say, put her in the witness box, and, taking purposely one variable at a time, analyze her secrets much more thoroughly. It is entirely owing to the exploitation of the experimental method that medical knowledge has bounded forward in the last half century out of all comparison with its previous progress; and nowadays we can get down to the experimental method in real earnest.

SCIENCE OF OPHTHALMOLOGY

It may be said that the advances of which I speak are physiological rather

than clinical. But advances in the practice of medicine can only go as far as the fundamental sciences on which they are based have advanced. That, I think, is the most hopeful aspect of the matter, for it may be that we are at last approaching a stage where a *science* of ophthalmology may begin to emerge. By that I mean an organized system of knowledge dealing with first principles upon which a study of disease of the eye can be philosophically based.

What, for example, are the common denominators whereby a cell in the cornea, the lens, or the retina changes its reaction, loses its bipolarity, and dies? Suppose, to look at it the other way, I take one fundamental process, a failure in intracellular oxidation—caused, of course, by many factors—how many of the hundred diseases of the cornea would that embrace in a single rational generalization—as well, perhaps, as the whole of the pathology of the lens?

The defect of ophthalmology at its present stage of development is that it is too compartmentalized, lacking an ordered sequential philosophy of cause and effect.

Observational ability is indeed plentiful, but the wisdom required to assess the mass of observations is at a much higher premium.

Can I illustrate this in two ways? In the first place, in our clinical thinking and in our textbooks, we tend to visualize diseases as if they were specific entities like butterflies or flowers to be labeled or classified in a museum. In like manner we demonstrate to our students an unending series of disease-pictures which they are supposed by a prodigious feat of memory to collect and store, each in a separate compartment, before they go out into the world.

If medicine did not progress, there might be some practical reason in this. But as medicine advances the disease-

pictures alter, new descriptions of associated symptoms appear, and new conceptions call for a new nomenclature; and furnished only with dogmatic teaching and untaught to reason and synthesize from first principles, because the first principles are as yet not clear, he is often lost if the groove in which his mind has been trained changes its shape.

Each new disease, however, that appears in the literature is not a new morbid entity discovered as Columbus discovered America. It is merely the recognition of a reshuffling of the basic reactions of the tissue cells; and, although the disease-pictures are artificial and ephemeral, if we go deeply enough, the underlying basic reactions to disease are perpetual and always remain unchanged.

INTEGRATION OF RESEARCH

So, too, with research: it is yet in large measure the making of a mass of observations, most of them disparate, with too little of the philosophy of synthesis and integration. For too long we have been forced to accumulate masses of apparently unrelated facts which swell beyond all reason a vast literature. As yet, they await adequate interpretation and integration into a body of coherent thought.

As the pile of information gets higher we require more and more time to acquaint ourselves of it and have less and less time to think about it. Like George Bernard Shaw we shall require to go back to Methuselah and live for 400 years if we are to be really wise, unless someone can find the common denominators, the basic generalizations by which our vast knowledge can be synthesized into a coherent scheme.

This stage may not be so very far away. And even if our first schemes are temporary—partly or even largely wrong—they will certainly serve a useful purpose if they merely act as a scaffolding for further constructive building.

RESPONSIBILITIES OF THE FUTURE

I would like to close with a remark on our responsibilities at the present time. I have seen most of the European countries since the war ended, excluding those, of course, in the East which are guarded with such secrecy by our allies. They all show the same physical picture of destruction and abolition of facilities, the same mental condition of fatigue and apathy. Out of Europe and particularly out of Germany a great amount of research and original thought used to emanate year by year by which our science was constantly enriched.

For a generation at least, and probably for two, this rich reservoir will be dried up. Research is not an easy thing to start, and, apart from individual brilliant exceptions, the student requires to be inspired by teachers who themselves have grown up in the stimulating atmosphere and philosophic background of research.

I do not think that European culture is dead: it is too traditional and fundamental in European thought and life to be killed so easily. But it is very tired: and, if I am right in thinking that as a result of the catastrophic break in the continuity of original scientific thought in a collapsed Europe, a whole generation will need to live and die before a full renaissance of research can be expected, it follows that the duty and responsibility of maintaining progress, of keeping alive the traditions of research and handing them back again to a recovered Europe devolves upon the English-speaking world, for there is no other competent. That means, at the moment, at any rate, that the survival and the revival of ophthalmology—the realization of all these intriguing potentialities—depend upon the United States of America, with its greater size, its larger facilities, and its escape from material destruction, that is, essentially upon you in this Society.

63 Harley Street (W. 1).

NEW YORK AS AN OPHTHALMOLOGICAL CENTER*

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New York

It is an old story, often repeated, how in the year 1816, Edward Delafield and John Kearny Rodgers, while attending lectures at the London Eye Infirmary, now the Royal London Ophthalmic Hospital, resolved, with youthful aspiration, to found a similar charity in their native New York—"for the first time in Ameri-

official title of New York Eye Infirmary, received a charter from the legislature, for the purpose, in quaint and sweeping terms, of "curing indigent persons affected with blindness and other diseases of the eyes and ears." From the seed thus sown sprang the New York Eye and Ear Infirmary (fig. 1) and indirectly all kin-

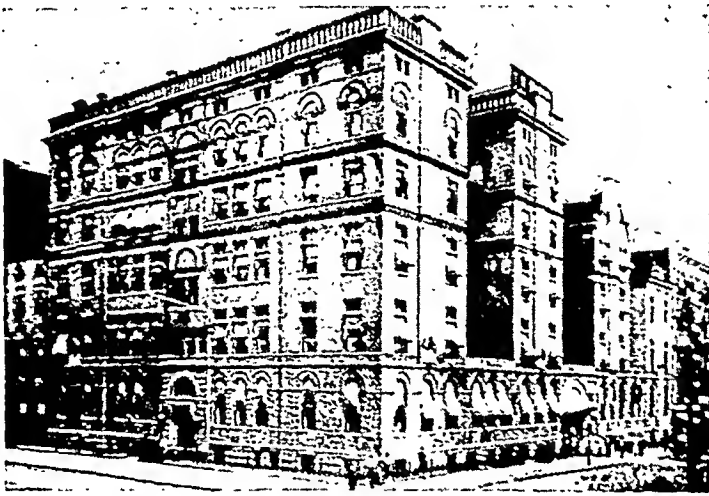


Fig. 1 (Samuels). Present buildings of the New York Eye and Ear Infirmary at Second Avenue and 13th Street.

ca," as they declared. In fulfillment of this resolve, they opened the New York Eye Infirmary on August 14, 1820. The first recorded patient to come on that day to the first eye clinic in New York was one suffering from a fistula of the lacrimal sac. It is of interest that this individual disappeared before the treatment was concluded, thus becoming the first of an ever-lengthening line of runaway eye patients!

In March, 1822, this month a century and a quarter ago, the charity, under the

dred institutions now existing in this city.

Any account of the rise and progress of ophthalmology in New York during the early years must be told in terms of this Infirmary, for around it revolved all matters that concerned the eye and its diseases.

Ophthalmology was the first branch of medicine in New York to be accorded recognition as a distinct specialty by the profession and by the lawmakers of the state.

The early staff of the Infirmary were general practitioners connected with the New York Hospital (fig. 2) who sought to learn to treat disease of the eye, and

* Read before the Section of Ophthalmology of the New York Academy of Medicine at the celebration of the Centenary of the Academy, on March 17, 1947.



Fig. 2 (Samuels). An early view of New York Hospital.

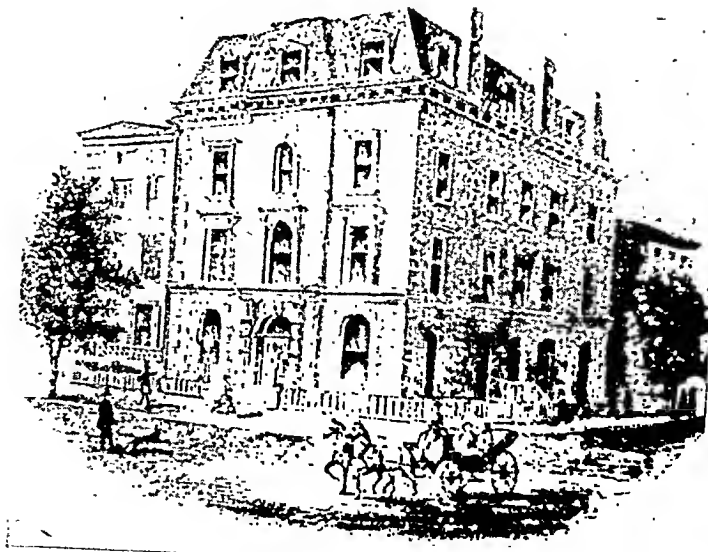


Fig. 3 (Samuels). The first home of the New York Eye and Ear Infirmary.

to teach others to do so, as skillfully as they believed they were treating disease of other organs. They argued that in no better way could these purposes be attained than in an infirmary to which those suffering from disease of the eye could be referred and there lodged and nursed. The idea of a physician's devoting his practice solely to the eye was far from their thoughts.

During the first 30 years of the life of the Infirmary, little advance was made in the practice of ophthalmology. The methods that the founders had introduced from London were continued. Focal illumination and the magnifying glass had not come into general use. Trachoma, which was prevalent, was treated, year in and year out, with touchings of silver nitrate and the copper stick. Atropine was the only mydriatic known, and it was not realized that its use might cause glaucoma. Miotics were unknown. The tension, taken with the fingers, was recorded as natural or hard or soft. To prescribe glasses was considered beneath the dignity of a physician. People "selected" their glasses, even after cataract extraction, from opticians as had been done for centuries.

The Infirmary, after occupying one remodeled building after another, in 1856, settled down at its present site in a structure specially built for its use (fig. 3). Here it has stayed for 91 years, a longer period in one place than has any other hospital in New York except Bellevue. The dedication of the Hospital came at an opportune time, in the middle of the most fruitful and brilliant decade in the history of ophthalmology. In 1851, Helmholtz produced the ophthalmoscope which revolutionized the diagnosis and treatment of disease of the eyes. A brief four years later Jaeger, in Vienna, published an *Atlas of Diseases of the Fundus*, drawn and colored so true to nature as to

be unexcelled. In 1856, Donders published his work on the *Anomalies of Accommodation and Refraction*. In 1857, Graefe gave to the world the operation



Fig. 4 (Samuels). Cornelius R. Agnew.

of iridectomy for the treatment of glaucoma.

In no other city was the effect of the knowledge that was unfolding in Europe more potently felt than in New York. Just prior to the Civil War, Cornelius R. Agnew (fig. 4) and Henry D. Noyes (fig. 5) returned to the Infirmary after completing their medical training abroad as was the practice of the times. They had studied under Graefe, Donders, and Bowman, known as the triumvirate of ophthalmology. Provided with the facilities of a new hospital, they instructed their less-traveled colleagues in the use of the ophthalmoscope, a cumbersome instrument difficult to master. The first evidence of experience with the new instrument is shown in the *Annual Report of the Infirmary for 1860*, in which appear such terms

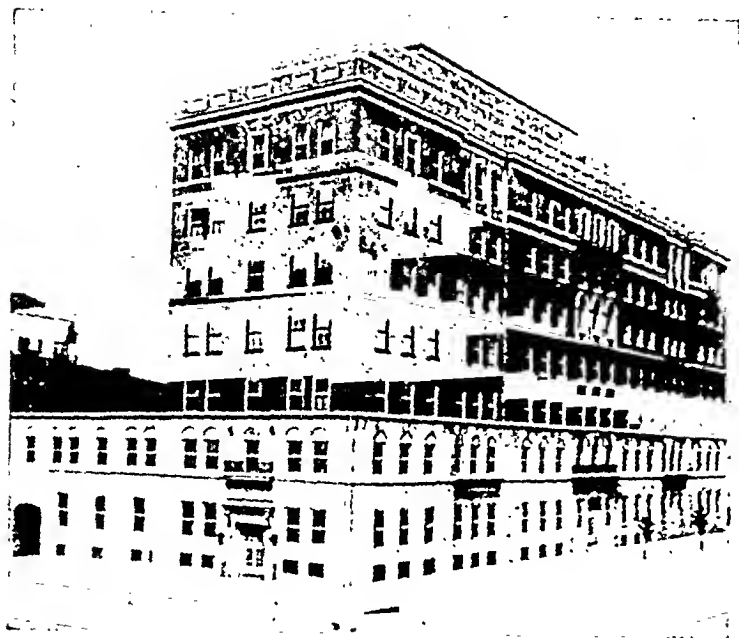


Fig. 6 (Samuels).
The Brooklyn Eye and Ear Hospital.

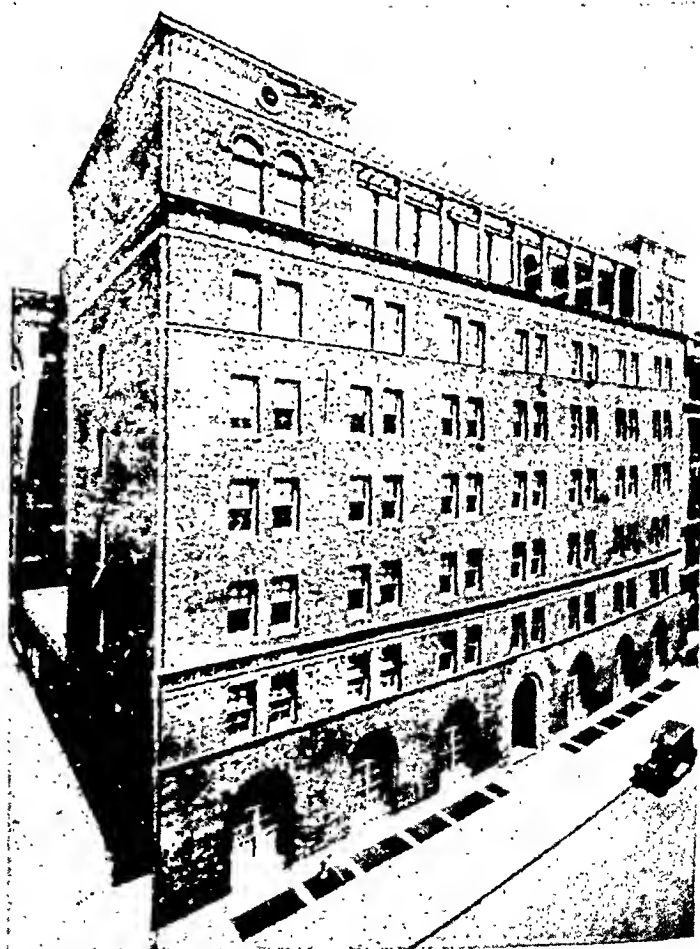


Fig. 7 (Samuels). The
Manhattan Eye, Ear, and
Throat Hospital.

as choroiditis, tumor of the choroid, apoplexy, and detachment of the retina. The following year optic-nerve atrophy was added to the list. Not long after astigmatism was recorded, which implies that the surgeons were reading Donders!

In 1864, in recognition of the fact that disease of the ear had always been treated at the Eye Infirmary, the title was legally changed to the New York Eye and Ear Infirmary.

The occasion permits of scarcely more than mention, in chronological order, of eight institutions of similar kind that have come into existence since the Infirmary was founded. Probably no city can boast of having had so many.

THE NEW YORK OPHTHALMIC HOSPITAL

The New York Ophthalmic Hospital was founded in 1852, chiefly to afford facilities for the instruction of medical students in the treatment of diseases of the eye. At first the allopaths had charge of the treatment but, as the Hospital did not prosper under this system, it was placed in the hands of the homeopaths who continue its long and praiseworthy career in association with Flower-Fifth Avenue Hospital and New York Medical College.

THE BROOKLYN EYE AND EAR HOSPITAL

The Brooklyn Eye and Ear Hospital (fig. 6) was founded in 1868 under the leadership of Agnew. Its birthplace was a remodeled dwelling house. No sooner had it settled down than it was dispossessed to make room for the east approach to the Brooklyn Bridge while the west approach overshadowed the birthplace of the old Infirmary. It now carries on its enormous work in a building which for equipment, size, and beauty is the pride of the profession.

THE MANHATTAN EYE, EAR, AND THROAT HOSPITAL

The Manhattan Eye, Ear, and Throat Hospital (fig. 7) was opened in 1869, in a remodeled residence, also under the auspices of Agnew. At first it was empowered by charter to treat only diseases



Fig. 5 (Samuels). Henry D. Noyes.

of the eye and ear, as its name then implied. Later a nose and throat department was instituted and still later a department of nervous diseases was added. It is authorized to conduct a school for the teaching of these subjects. The Manhattan is famous not only for the wealth of its clinical material but also for the variety of activities carried out under its roof. Here the idea for the Eye Bank to ensure material for corneal transplantation originated. Here is conducted a clinic devoted exclusively to the treatment of glaucoma, sponsored by the National Society for the Prevention of Blindness.

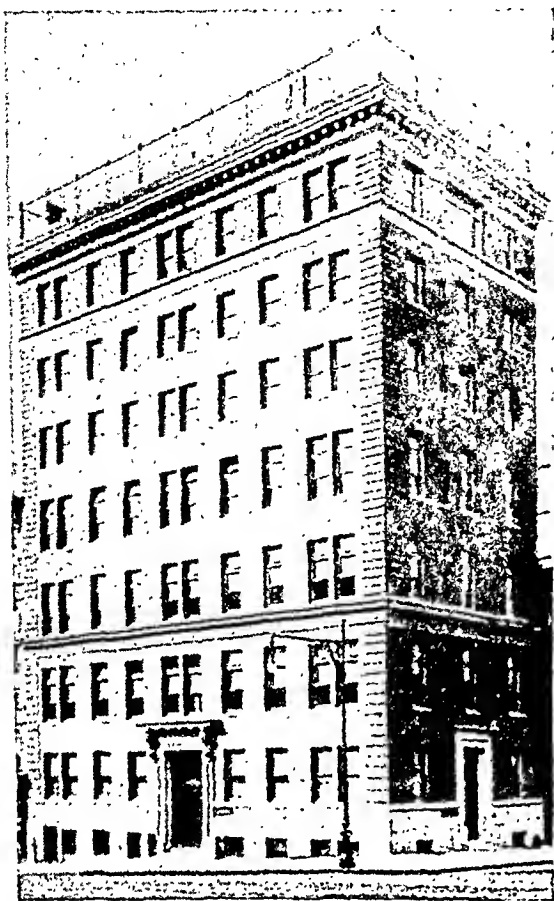


Fig. 8 (Samuels). Herman Knapp Memorial Eye Hospital.

THE HERMAN KNAPP MEMORIAL EYE HOSPITAL

In the minutes of a meeting of the Academy, in 1868, there is an entry that Herman Knapp, late Professor of Ophthalmology of Heidelberg, was introduced. Although insignificant in itself, this scene marked the beginning of a career that was to exert a profound influence. A year later, under charter by the state, Knapp opened the Ophthalmic and Aural Institute in two private residences. It was conducted after the pattern of Graefe's famous eye clinic in Berlin, where the poor crowded into the lower stories while the rich thronged into the upper ones. Eye hospitals in New York had been solely the refuge of the poor. The well-to-do were operated upon

in their own homes. The admission of private patients into the Institute made scandal, which sounds strange today when private, semiprivate, and ward-private patients all but dispossess the indigent. The Institute grew so rapidly that in a brief period only the New York Eye and Ear Infirmary and the Massachusetts Charitable Eye and Ear Infirmary drew more patients. Its independent life spanned 70 "honorable years." More recently, it was known as the Herman Knapp Memorial Eye Hospital (fig. 8). Finally, in 1941, it was merged with the Eye Institute of the Presbyterian Hospital.

THE HARLEM EYE AND EAR INFIRMARY

The Harlem Eye and Ear Infirmary (fig. 9) received corporate powers in 1881. It was the first special hospital located north of 41st Street. It began in a little room back of a plumber's shop, the most lowly birthplace of any. Largely through the efforts of public-spirited residents of the neighborhood, a splendid structure has been provided.

THE NEW AMSTERDAM EYE AND EAR HOSPITAL

The New Amsterdam Eye and Ear Hospital was established in 1888. It was destined not to advance beyond the altered private-residence stage. In 1911 it received permission from the courts to sell its property and "cease to exist"—an example of what happens when a hospital gets too deeply into debt!

THE BRONX EYE AND EAR INFIRMARY

The Bronx Eye and Ear Infirmary (fig. 10) received its license from the State Board of Charities in 1901. It is maintained primarily for the benefit of all persons unable to pay, suffering from disease of the eye, ear, nose, and throat. Its modern building bears witness to its signal success.



Fig. 9 (Samuels). The Harlem Eye and Ear Hospital.

THE INSTITUTE OF OPHTHALMOLOGY

In 1933, the Institute of Ophthalmology (fig. 11) came into being, under the most auspicious circumstances, as a unit of one of the world's largest and richest hospitals. It is the only foundation in the city devoted exclusively to the eye. Facilities for the treatment of ocular disease are combined with opportunities for sci-

entific study. Its success was assured by the appointment of John Martin Wheeler, a gifted surgeon, teacher, and executive, as its first director. Its staff was largely recruited from that of the old Infirmary which has served as a sort of proving ground for almost every similar hospital in Greater New York. The Institute has set an example of a cultural kind by

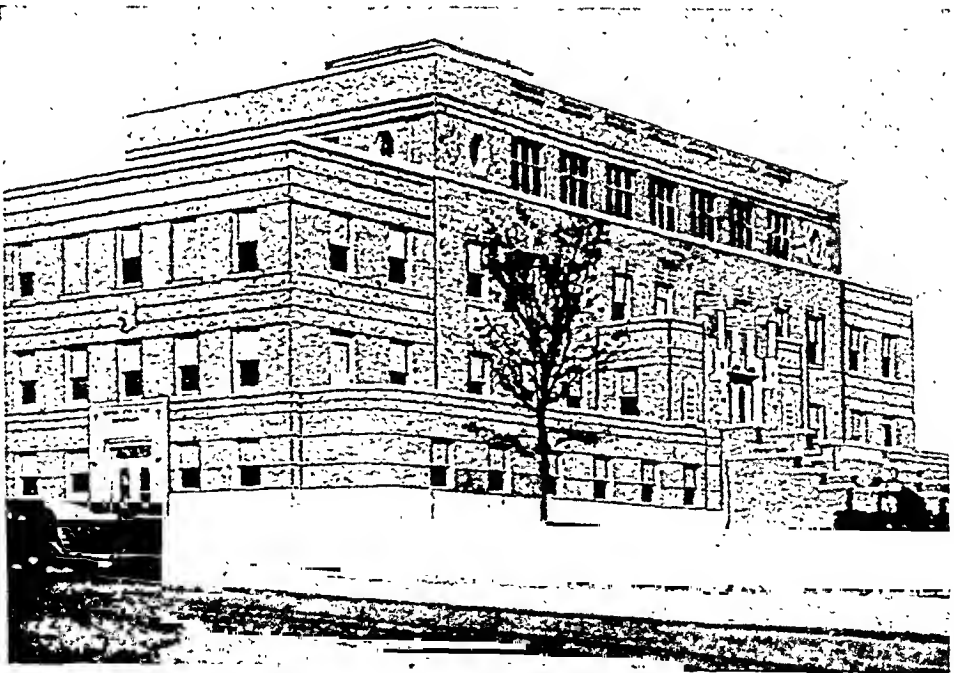


Fig. 10 (Samuels). The Bronx Eye and Ear Infirmary.



Fig. 11 (Samuels). The Institute of Ophthalmology.

organizing a museum in which instruments, manuscripts, and letters of historical interest form the nucleus of a rare collection. The library contains 5,000 bound volumes and over 5,000 reprints.

THE NEWARK EYE AND EAR INFIRMARY

Although the Newark Eye and Ear Infirmary is in another state, New York claims it as its own. It started in 1880, like others, in a remodeled residence. Faithful to its consecration, no patient has ever been turned away because of inability to pay.

SURGERY

Good surgery is traditional in New York. In the early days, ophthalmic surgery fell within the domain of the general surgeon. John Kearny Rodgers, one of the most distinguished surgeons of New York, as an eye operator, was

described as being "quick, skillfull, and brilliant." Rodgers taught Noyes, who paved the way for Weeks in plastic surgery, and Weeks taught Wheeler and Goldstein. So elegant and dexterous were the three in plastic work that men came from far and wide to witness it. Robert G. Reese and Edgar S. Thomson were noted for the success of their intraocular operations—to watch them was considered to be educational. Jameson's procedure in muscle operations is a standard in surgery. Pressing forward in even greater refinement of technique, the surgeons on active duty are worthy successors. There is value in working in groups; thus, the staff of one hospital may excel in the extraction of cataract, the staff of another in glaucoma operations, and the staff of still another in corneal transplantation. As a matter of course, whoever would keep abreast of ophthalmic

surgery comes to New York and makes the grand rounds.

TEACHING

It has been said that the creation of every hospital means at once the creation of a school. Scarcely had the old Infirmary been started before an entry appears in the minutes that a series of lectures on the eye had been begun by Delafield. In the first years, in order to stimulate

to the schools of Europe. There is being given today by the Medical Department of New York University a postgraduate course on the eye which for organization, scope, and large number of students probably surpasses any previous effort of its kind. The Instruction Hour conducted before each stated meeting of this Section serves good purpose. The Refresher Course, given here and there, is so timed as to come just before the meeting of

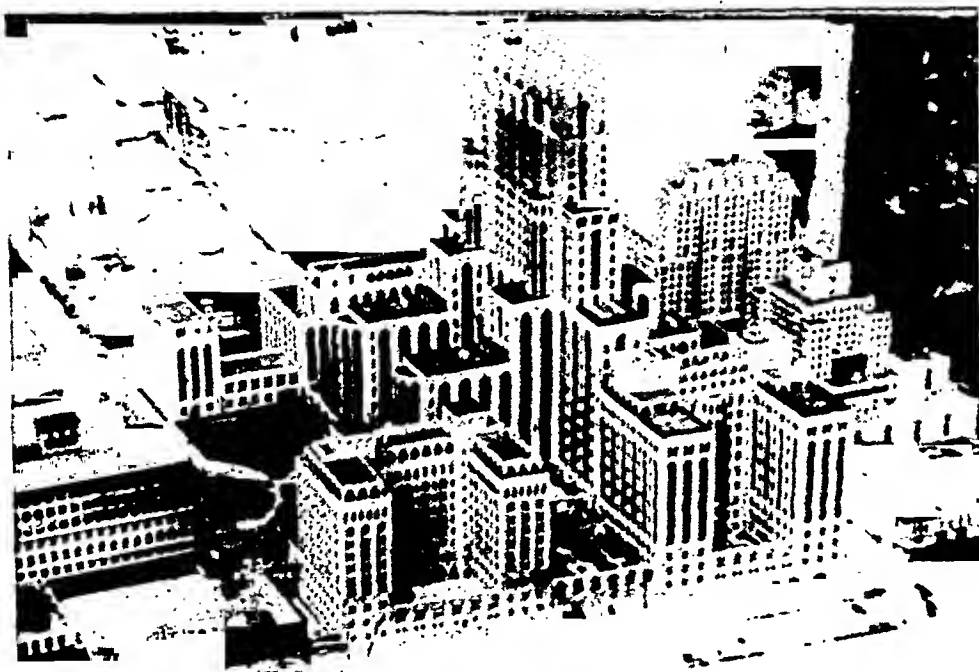


Fig. 12 (Samuels). An aerial view of New York Hospital.

the teaching of ophthalmology, the state went so far as to make an annual appropriation, the Infirmary contracting to allow two physicians from each county to witness the practice and surgery. The first systematic course in ophthalmology was that given by the homeopathic New York Ophthalmic Hospital in the 1850s. This is the only hospital authorized by law to confer a degree: *oculi et auris chirurgus* (Surgeon of the eye and ear). The New York Ophthalmic and Aural Institute conducted courses that rivaled those that had hitherto lured Americans

the American Board of Ophthalmology.

Uninterruptedly through decades the New York Postgraduate School and Hospital and the New York Polyclinic Medical School and Hospital have attracted a stream of students from all over the world, adding immensely to the prestige of ophthalmology in this city. The Department of Graduate Medical Instruction of Mount Sinai Hospital, in its ophthalmic division, has cause to be proud of the men it turns out. The New York Hospital, which sheltered the Infirmary from 1824 to 1826 and then withdrew its

help, as if to make amends for lack of vision, now maintains in connection with Cornell University Medical College (fig. 12) an eye department which is in all but name an institute. Who does not recall with gratitude, at the threshold of his career, some assistant surgeon who, while inconspicuously bearing the brunt of the clinic, went out of his way to instruct and hand down the traditions of his specialty?

RESEARCH

In 1887, John E. Weeks (fig. 13) read a paper before this section entitled: "The



Fig. 13 (Samuels). John E. Weeks.

Pathogenic Microbes of Acute Contagious Conjunctivitis, Based on 250 Cases Observed—Popularly Known as Pink Eye." This was the fruit of the clinic and laboratory of the New York Ophthalmic and

Aural Institute. In recognition of the fact that Knapp equipped and supervised the research work in this laboratory, which was the first of its kind in any eye hospital in the United States, it is fitting that an endowment, under the control of Columbia University, should bear the name of the Herman Knapp Memorial Foundation in Ophthalmology. The income derived from the endowment is expended for study, postgraduate teaching, and fellowships.

The Ophthalmological Foundation, Incorporated, has for its chief purposes the organization of research in problems relating to blindness and the compilation and distribution of information on this subject in coöperation with the National Society for the Prevention of Blindness. The Eye Surgery Fund, Incorporated, seeks to provide books, instruments, and models for the instruction of residents. To assist in solving an obscure surgical problem, it may defray the hospital expenses of the patient and provide the means for the publication of the case. The Eno Laboratory of the New York Eye and Ear Infirmary has accumulated thousands of microscopic preparations of the eye which are so classified as to be available for investigations. Not the least service rendered by the endowments is the scientific spirit that they are arousing. Whereas, formerly, research in hospitals was scarcely tolerated, now it is the avowed policy to foster it.

LITERATURE

A vast literature has emanated from the pens of New Yorkers in the form of books, treatises, monographs, atlases, and articles in current journals. To name a few, the textbooks by Noyes and Weeks were comprehensive and widely used in their time. Loring's *Textbook of Ophthalmoscopy*, with the ophthalmoscope that he devised, served to enlighten a whole

generation. Herman Knapp enriched the literature by the importance and number of his contributions. In 1869, he founded the *Archives of Ophthalmology*, in which the Transactions of this Section have always appeared. Török and Grout's *Surgery of the Eye* and Oatman's *Diagnosis of the Fundus Oculi* came out in 1913. The *Collected Papers of John Martin Wheeler*, which reveal the progress of his surgical career from 1909 to 1938, are invaluable. May's *Manual of the Diseases of the Eye*, now in its 17th edition, speaks for itself. *The Eye and Its Diseases*, edited by Berens, is consulted by all. Berliner's *Biomicroscopy of the Eye* is indispensable in the library. Troncoso's *Internal Diseases of the Eye* and *Atlas of Ophthalmoscopy* has been followed in rapid succession by Evans' *Introduction to Clinical Scotometry*, Elwyn's *Diseases of the Retina*, Hughes, *Reconstructive Surgery of the Eyelids*, and Berens and Suckerman's *Diagnostic Examination of the Eye*. Duane's translation of Fuchs's *Diseases of the Eye*, with his own chapter on muscles, aside from its inestimable medical value, is a literary product of the highest order. No such monumental opus as the *System of Diseases of the Eye*, in four quarto volumes, by Norris and Oliver of Philadelphia, has ever been attempted by New Yorkers, but, nevertheless, they have done their full share in the written word.

THE LOCAL SOCIETIES

The New York Ophthalmological Society was organized, in 1864, by men

who had formed warm friendships while pursuing their studies abroad. For many years the members met in one another's homes. To this day a cordial and informal atmosphere pervades its meetings. The Brooklyn Ophthalmological Society is of proud lineage. Its meeting place is the

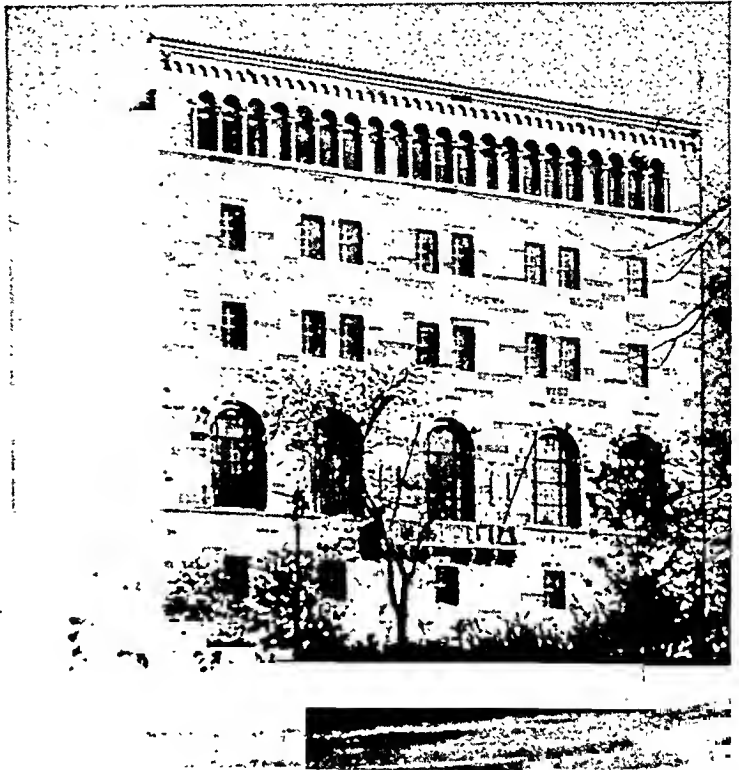


Fig. 14 (Samuels). The New York Academy of Medicine.

King's County Medical Society Building, which houses a select and extensive collection of eye books. There is still another society, recently organized, the New York Society for Clinical Ophthalmology. Its chief aim is to make its programs valuable and instructive to younger men. Its meetings, preceded by an "instruction hour," are held at the Academy.

THE NEW YORK ACADEMY OF MEDICINE

The observance of the Centenary of the New York Academy of Medicine (fig. 14) is in a very particular sense of interest to ophthalmologists. It was Dela-

field (fig. 15) who conceived the idea of an academy and it was he who became its first president. Rodgers (fig. 16) was one of its incorporators, and at his funeral, in 1851, the Academy attended



Fig. 15 (Samuels). Edward Delafield.

in a body. The Section of Ophthalmology is one of 12 sections into which the Fellows of the Academy are divided. In 1885, ophthalmology and otology were combined to form one section. At the breaking up of this dual relationship, in 1900, the regular meeting night, the third Monday of the month, fell to ophthalmology and so it has been these 62 years. Almost the first act of the dual section was to appoint a committee to ascertain the number of books on these specialties in the library. The committee reported 160 books on the eye and 40 on the ear. Today the eye books and monographs number about 2,500 and on the racks are to be found some 30 current journals on this subject. The library of the Academy ranks second in size to that of the Sur-

geon General's in Washington. It contains many old and rare books on the eye. It is the repository of the minutes of the American Ophthalmological Society and the New York Ophthalmological Society.

In spite of every facility for access to books that the Academy offers, New Yorkers vie with one another in collecting and possessing their own books. Notable are the fine libraries owned by Arnold Knapp, Ralph Lloyd, and Conrad Berens.

An invitation to become a Fellow of the Academy is an honor not to be taken lightly. This is the forum in which the Fellows from all the eye hospitals gather to present cases, read papers, and discuss the medical affairs of the day. Here distinguished guests are received and



Fig. 16 (Samuels). John Kearny Rodgers.

entertained. Many associations endear these walls to us. Here, as death takes its toll, the work and measure of each Fellow is reverently recounted. In the midst of

this high celebration we should not be unmindful of those who, although not of our calling, have made this imposing fabric possible and have looked after the material concerns of hospitals and clinics through the years.

In the progress of this paper on "New York as an Ophthalmological Center" it came to me as a surprise that nowhere is there vaster clinical material; nowhere

is there more or better surgery; nowhere greater facilities for teaching; and nowhere are there so many incentives for research work. I trust that I am not too indulgent when I venture to express the opinion that in no metropolis in the world is the art and science of ophthalmology more sedulously cultivated than in New York.

57 West 57th Street (19).

DICUMAROL AND RUTIN IN RETINAL VASCULAR DISORDERS*

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Baltimore, Maryland

INTRODUCTION

Two retinal vascular problems confront the ophthalmologist: (1) Hemorrhage following capillary weakness. (2) Occlusion as the result of thrombosis, periphlebitis, atherosclerosis or constriction. Today, chemotherapeutic agents are available which show promise for alleviating some of these conditions. In-vivo anti-coagulants (heparin and dicumarol) for inhibiting the thrombotic process and preparations possessing vitamin-P properties (hesperidin and rutin)[‡] for decreasing capillary fragility are being subjected to critical clinical evaluation. It is the purpose of this report to present the concomitant use of these two groups of chemical substances in vascular retinopathies.

Since obstruction of the retinal veins was first described by Julius v. Michel in 1878,¹ the matter has been the subject of almost continuous research, but even today many points, both in the etiology and the intimate mechanism of the obstruction, are still unelucidated. The general mechanism of the occlusion is somewhat complicated depending usually upon events both in the arterial and the venous parts of the circulation.

Duke-Elder² has described four stages in the mechanism of retinal venous occlusion:

(1) A slowing of the blood flow which is a necessary prelude to thrombosis. This process is usually determined by events occurring in the arteries and veins. The entrance flow may be diminished owing to a general loss in vascular tone, or frequently to mechanical constriction at the lamina cribosa by the proliferation of the surrounding connective tissue. The net result is an impedance of arterial flow and a damming back of venous return.

(2) The formation of a roughened area on the endothelium. The roughening may be due to simple atheromatous enlargement of the adjoining artery causing indentation of the vein and trauma to its

* From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University and the Department of Clinical Biochemistry, Mercy Hospital, Baltimore, Maryland. Read at the 82nd annual meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.

[†] By invitation.

[‡] The Abbott Laboratories, North Chicago, Illinois, generously supplied the rutin and hesperidin used during the course of this investigation.

endothelium. Most commonly, however, it is an expression of an endophlebitis of systemic origin for which no particular toxin but probably a large number must be held responsible.

(3) Upon this area cells and fibrin are deposited so that a nodule or organized thrombus protrudes into the lumen of the vein. The thrombus grows by accretion in the relatively stagnant blood stream until the lumen is reduced to a mere slit and the local circulation brought almost to a standstill.

(4) Verhoeff³ considers that thrombosis in the true sense is exceedingly rare, but that it is the proliferative activity of the vein endothelium which continues to build up a nodule which similarly gradually fills the lumen. A review of the current evidence reveals that such a process appears unlikely since obliterative endothelial proliferation in veins has not been established histologically.

Heparin⁴ has been used in retinal venous occlusion for short periods with encouraging results. However, there appears to be some disagreement as to the efficacy of this anticoagulant therapy.⁵ Dicumarol 4-g has likewise been used to a limited extent. It is our purpose to present the clinical application of anti-coagulant administration for long periods to ambulatory patients.

Dicumarol (3-3) Methylene-bis (4-Hydroxycoumarin) is a compound found in spoiled sweet clover which has been known to produce a hemorrhagic disease in cattle. It was isolated from spoiled sweet clover and later synthesized by Link⁶ and his associates at the University of Wisconsin. When dicumarol is administered orally, the prothrombin activity of the blood is reduced⁶ and intravascular thrombosis,⁷ as well as intravascular coagulation, is inhibited.

No evidence is available that damage to the endothelial lining is incurred dur-

ing controlled treatment with dicumarol. The factors involved in capillary bleeding are still obscure and the subject of many conjectures.

Anticoagulants may be used for inhibiting the conversion of fibrinogen to fibrin. In this manner the enlargement of the clot by continued fibrin deposition may be prevented. The performed thrombus, if its growth is checked, may in a number of instances retract, leaving a lumen for the passage of blood. Substances manifesting antipurpuric properties⁸ (rutin⁹ and hesperidin¹⁰) were used to decrease capillary fragility when present.

CLINICAL MATERIAL

The present series includes 21 cases of a number of vascular retinopathies observed in private practice (table 1); that is, tributary occlusion, two; central vein occlusion, partial, six; diabetic retinopathy, four; degenerative retinopathy, five; central serous retinopathy (angiospastic), two; and Eales' disease, two. The age of the patients varied from 34 to 72 years. With the exception of the two patients with Eales' disease (who were placed on rutin administration alone), all the patients received dicumarol ranging from 4 to 40 weeks' duration. The two cases of tributary thrombosis were placed on dicumarol alone,* while the remainder of the patients were subjected to concomitant administration of rutin and dicumarol. Detailed ophthalmoscopic examination of the patients was made periodically during the course of treatment with dicumarol and rutin.

RATIONALE

Premonitory signs of vascular retinopathies are not often recognizable, and hence the initial process cannot be prevented. Four processes are involved:

* Rutin was not available at that time.

hemorrhage, thrombosis, atherosclerosis and exudative congestion. These will be considered under three general headings: (1) Thrombosis primary and hemorrhage secondary; (2) Hemorrhage primary and thrombosis secondary; and (3) Degenerative retinopathy.

THROMBOSIS PRIMARY—HEMORRHAGE SECONDARY

Thrombosis results in building up of the back pressure with engorgement of vessels with blood. The consequence of this condition is a rupture of the vessels from the breakdown of vessel wall elasticity, giving rise to hemorrhagic areas. Secondary thrombosis in the damaged capillaries may take place as a protective mechanism. This thrombotic process may progress and contribute to the existing pathologic picture resulting in a decreased vascular efficiency.

Under such circumstances dicumarol or other in-vivo anticoagulants to inhibit the existing thrombotic tendencies would be indicated. Also, rutin or other vitamin-P-like substances would be therapeutically indicated to improve capillary integrity. The clinical conditions encountered in this category are tributary occlusion and central-vein occlusion, partial or complete.

HEMORRHAGE PRIMARY—THROMBOSIS SECONDARY

When hemorrhage is the primary cause of the retinopathic state, two general clinical conditions must be considered: Hypertension and idiopathic capillary weakness giving rise to recurrent hemorrhages. In hypertension there may be a sudden increase in blood pressure together with an increased capillary fragility¹⁰ frequently attendant with this condition. The vessel walls rupture, giving rise to a hemorrhagic area. Here again, secondary thrombosis occurs in

the damaged capillaries as a protective mechanism and contributes to the existing pathologic picture.

Under these circumstances, rutin or other vitamin-P-like substances to improve capillary integrity would be therapeutically indicated. In a number of cases the Gothlin Index¹⁰ of capillary fragility is also increased. Dicumarol cautiously and conservatively administered would be indicated to inhibit differentially the thrombotic processes involved (about 60 percent of normal prothrombin activity). This routine of concomitant administration of these two drugs should increase the rate of absorption of the hemorrhages, and the possibility of new ones should be reduced.

In Eales' disease, where recurrent hemorrhages of questionable etiology occur, the same therapeutic indications should apply.

The use of anticoagulants should not exaggerate the existing hemorrhagic picture provided the above-mentioned conditions are meticulously observed. It is to be realized that experience, discretion, and satisfactory methods for the control of the coagulation system are of utmost importance.

DEGENERATIVE RETINOPATHY

Here one encounters an idiopathic, impaired vascular efficiency resulting in localizing degenerative and proliferative processes with exudative congestion.² Localized capillary occlusion or angiospasm may be the contributing factors. Administration of dicumarol or other in-vivo anticoagulants to inhibit thrombotic tendencies or cellular adhesiveness should facilitate circulation. Rutin or other vitamin-P-like substances to improve capillary integrity would also be therapeutically indicated.

Administration of adequate amounts of anticoagulant may prevent extension of

the thrombus. For economical reasons, and because of the ease of administration and control, dicumarol was selected as the anticoagulant of choice. While heparin institutes an immediate effect, its administration raises practical difficulties.

METHODS

Prothrombin clotting-time determinations have been done by Quick's¹¹ method using a modified standardized thromboplastic reagent as described by Brambel:¹²

"Four and one-half cubic cm. of freshly drawn blood was introduced into a graduated centrifuge tube containing 0.5 cc. of tenth-molar solution of sodium oxalate. The tube was inverted several times and centrifuged to obtain clear plasma.

"In the performance of the test, 0.1 cc. of clear plasma was placed in a small tube, to which 0.1 cc. of modified thromboplastic reagent was added. After thorough shaking of the contents, 0.1 cc. of 0.025 molar solution of calcium chloride was added to the mixture. A stopwatch was started and the tube placed immediately in a water bath adjusted to 37.5°C., in which it was tilted back and forth until the formation of a firm clot was observed. Normal undiluted plasma coagulated in thirteen to fifteen seconds.

"Five-tenths cc. of clear, oxalated plasma was added to 3.5 cc. of 0.85 percent saline solution to obtain a 12.5 percent dilution. One-tenth cc. of this diluted plasma was pipetted into each of two small tubes. Thromboplastic reagent and calcium chloride solution (0.1 cc. each) were added to each one, and both tubes were placed in the water bath. They were tilted back and forth until a web clot appeared at the rim of the meniscus. Normal 12.5 percent plasma clotted in eighty-five to ninety-five seconds. Usually, the two tubes showed a web clot simultaneously, but if small variations occurred, the two values were averaged."

Several investigations¹³ have shown that variations of prothrombin activity can be better detected with diluted plasma, particularly for demonstrating increased activity of the clotting components.

All of our cases manifested an increased prothrombin activity; that is, decreased prothrombin clotting time of 12.5-percent plasma. This finding has been interpreted as a manifestation of an enhanced clotting tendency of the blood of these patients compared to normal and is attendant with retinopathies rather than the cause of them.

The Petechial Index of Gothlin was determined by the method modified by Griffith and Lindauer:¹⁰ "Technique of the Test: (1) Mark off a circular area, 6 cm. in diameter, in each antecubital area. Mark off all blemishes and marks in this area that might be confused with petechiae; (2) place a standard blood pressure cuff about each arm, and maintain in each a pressure of 35 mm. of mercury for 15 minutes. Lower the pressure and count and mark all petechiae within the two circular areas, using a good light and a magnifying lens of 5D or its equivalent; (3) one hour or more later, repeat, using a cuff pressure of 50 mm. of mercury.

"The Petechial Index is calculated as follows: To the number of petechiae occurring at 35 mm. of mercury multiplied by 2, add the additional number occurring at 50 mm. Based upon the Petechial Index, capillary fragility is considered to be: (a) normal, if the index is 8 or less, (b) increased (abnormal), if the index is 13 or more, and (c) borderline, but probably abnormal, if the index is 9 or 12."

DOSAGE

No patient should be given dicumarol unless adequate laboratory facilities are available to check the prothrombin clotting time with appropriately standardized reagents. Otherwise, hazardous difficulties

may arise from failure to reproduce the desired depression of prothrombin activity. Experience and good judgment are essential in estimating dicumarol dosage on the basis of response of the coagulation system to the drug. Dicumarol was administered orally.

An initial prothrombin clotting-time determination was made on each patient before dicumarol administration was begun. The first dose was 300 mg. In view of the experience with a number of cases by one of us (C. E. B.) (now totaling 2,500) the next test was run in 48 hours, since the maximum effect of any given dosage is obtained after a period of 36 to 48 hours. In this manner the hyperreactors can be detected before the cumulative effect of several doses is manifest.

A series of subsequent determinations were made at two-day intervals with dosages of 100 to 300 mg. to maintain a coagulation activity level of 50 percent of normal (never exceeding a prothrombin clotting time of 30 seconds for undiluted plasma).

After it was satisfactorily demonstrated that the patient was not a hyperreactor and the response could be fairly well predicted, the patient was continued on dicumarol, returning to the clinic once a week for prothrombin clotting-time determinations and succeeding doses.

Although this procedure has been used with success in this series of cases, it is not generally recommended and, indeed, it is not without hazard unless complete coöperation of the patient, his physician, and the laboratory is obtained. For example, in the event of increased body temperature or kidney involvement following administration of other concomitant drug therapy, dangerous and unpredicted depression of prothrombin activity may be the consequence. Too much emphasis cannot be placed on this consideration.

Concomitant oral administration of rutin in 60-mg. daily doses was the usual routine and was kept up for the duration of the combined therapy. The patients were periodically checked for evidence of capillary fragility by the Gothlin test.¹⁰ In some selected cases, 125 mg. daily were given.

TOXIC EFFECTS

The two chemotherapeutic agents used in this series of cases presented minimal untoward side reactions. Reports in the literature reveal that dicumarol⁷⁻⁹ and rutin⁹ have been administered continuously for a period up to 2½ years without delayed toxic reactions.

Several investigators¹⁴ have shown that dicumarol does not disturb the formed elements of the blood, nor does it affect the capillary fragility and clot retraction when conservatively administered. Evidence has been presented¹⁵ that capillary damage may result when excessive amounts of this anticoagulant are used. The blood coagulation time is altered only after prothrombin activity is reduced beyond 50 percent of normal. Undesired or excessive hypoprothrombinemia, should it occur, can be controlled¹⁶ by the intravenous injection of 37.5 mg. of menadione bisulfite (72 mg. hykinone) or by fresh blood transfusion.

Notwithstanding the reports of a fairly substantial percentage of hemorrhagic incidents in some clinics,¹⁷ only one patient in this series of 21 cases manifested transitory frank hematuria and none showed microscopic hematuria. The explanation may be found in the fact that conservative administration of this anticoagulant to ambulatory patients was meticulously carried out. Occasional nausea or headache and a mild diarrhea (usually after the first dose) were the only immediate side effects noted. These disturbances were easily controlled.

The induced hypoprothrombinemic

state did not involve permanent functional impairment of the liver. On the contrary, return to a normal state of prothrombin activity within 72 hours was observed following cessation of dicumarol dosage regardless of the length of the period of administration. Pharmacologic and toxicologic investigations¹⁸ support these findings.

No toxic manifestations were observed

nite decrease in the prothrombin clotting time of dilute plasma compared to normal controls. These observations together with the ophthalmoscopic findings served as the basis for anticoagulant therapy.

In over half of the cases, rutin or hesperidin was administered as prophylaxis for possible capillary weakness. However, increased capillary fragility, as determined by the Gothlin Index, was positive

TABLE 1
RESULTS IN A SERIES OF 21 CASES OF A NUMBER OF VASCULAR
RETINOPATHIES TREATED WITH DICUMAROL AND RUTIN

Case Number	Name	Sex	Age	Prothrombin Time Un-diluted Plasma	12.5% Plasma	Total Dicumarol Mg.	Dicumarol Weeks Administration	Total Rutin Mg.	Rutin Weeks Administration	Vision Before Therapy	Vision After Therapy	Hemorrhages Exudates Edema
Tributary Occlusion												
1.	J. E.	M.	45	14	65	4700	5	0	0	20/100	20/20	Cleared
2.	F. R.	F.	70	15	74	16000	40	0	0	20/70	20/70	Clearing
Central-vein Occlusion, Partial												
3.	C. H.	M.	72	12	73	9200	18	0	0	20/100	20/20	Cleared
4.	J. K.	M.	50	16	94	2600	9	0	0	20/200	—	No follow-up
5.	L. K.	F.	68	15	64	4150	9	0	0	H. M.	20/200	Cleared, atrophic changes
6.	M. K.	M.	34	13	73	4300	14	5200	14	20/400	20/100	Clearing
7.	W. M.	M.	58	15	70	4300	14	5880	14	20/100	20/30	Clearing
8.	G. N.	M.	72	15	72	5400	20	8520	20	20/200	20/50	Clearing
Diabetic Retinopathy												
9.	A. C.	M.	68	14	56	7800	24	2160	8	20/50	20/30	Cleared
10.	L. K.	M.	58	15	71	11200	24	6480	18	20/200	20/70	Clearing
11.	M. M.	F.	60	13	60	700	4	0	0	20/50	—	No follow-up
12.	H. R.	M.	63	16	73	1300	4	0	0	20/400	20/50	Clearing
Degenerative Retinopathy												
13.	E. H.	F.	56	12	68	4400	25	5560	20	20/100	20/30	Clearing
14.	V. L.	F.	77	14	61	5300	15	3800	14	20/100	20/70	Some clearing, atrophic changes
15.	M. McC.	F.	61	14	64	3300	10	4200	10	20/600	20/200	Some absorption
16.	C. P.	M.	65	14	76	28900	40	0	0	20/70	20/30	Cleared
17.	F. R.	M.	78	15	48	3500	14	0	0	20/50	20/40	Cleared, atrophic changes
Central Serous Retinopathy (Angiospastic)												
18.	S. F.	F.	32	16	72	1500	3	1260	3	20/40	20/20	Clearing
19.	M. M.	M.	35	14	61	5400	14	3480	7	20/70	20/20	Cleared
Eales' Disease												
20.	E. P.	F.	60	—	—	—	—	3660	9	2/100	20/30	Clearing
21.	I. S.	F.	40	15	57	—	—	11120	20	L. P.?	H. M.	Clearing

with rutin. Repeated analysis of clinically significant components of blood chemistry and cellular elements showed no deviation from normal as a consequence of the use of this drug.

DISCUSSION OF RESULTS

The present series of cases of various retinopathic conditions manifested a defi-

only in cases of idiopathic hemorrhagic disease (Eales' disease).

The thesis that in-vivo coagulation-activating substances may be liberated in the blood stream is suggestively supported by the results obtained from anticoagulant administration by depressing the activity of one of the major components of the blood coagulation system; that is,

prothrombin. The interpretation of the pathology of the various retinopathic conditions presented in this paper is based on derangement of the blood coagulation system involving vascular efficiency.¹⁹

CASE REPORTS

TRIBUTARY OCCLUSION

The two cases of tributary occlusion (table 1, cases 1 and 2) showed an increased rate of improvement in visual acuity with disappearance of hemorrhages and exudates during treatment with dicumarol. No recurrence of symptoms was noted.

Case 1. Tributary occlusion of upper temporal vein. J. S. E., a 45-year-old white man, upon clinical examination in January, 1945, revealed hemorrhage and edema from the upper temporal vessels to the macula in the right eye involving tributary occlusion of the upper temporal vein. The vision at this time was 20/100. No improvement was noted for four months.

On April 23, 1945, the vision was still 20/100 when anticoagulant therapy was started. The initial prothrombin clotting-time determination showed a marked decrease in the clotting interval for diluted plasma; that is, 65 seconds (normal 85 seconds). After an initial dose of 300-mg. dicumarol, the prothrombin was altered only slightly, indicating a mildly refractory nature of the coagulation system. This patient required 600 mg. weekly in 200-mg. doses every two days. Dicumarol administration was continued for seven weeks with the prothrombin mechanism reduced to approximately 50 percent of normal when compared with standard dilution curves.

In May, 1945, ophthalmoscopic examination revealed that the hemorrhage was absorbing slowly and the vision was 20/40. An examination in September, 1945, revealed that absorption of the

hemorrhage was practically complete and the vision was 20/20. A wedge-shaped sector at the macula was the last to absorb. In February, 1946, some pigmentary atrophic changes were noted with whitish lines and tortuous vessels in the area that had been involved. No hemorrhagic manifestations were visible.

Comment. This patient showed very slow improvement during the four months preceding anticoagulant therapy, vision in the right eye remaining 20/100. Marked clinical improvement was noted after dicumarol administration was started, and vision in the right eye increased to 20/20. After cessation of the therapy, vision continued to improve to normal and has continued so to the present time without anticoagulant therapy.

CENTRAL-VEIN OCCLUSION

The rate of recovery of visual acuity and absorption of hemorrhages and exudates in the six cases of central-vein occlusion (table 1, cases 3-8; see figs. 1 to 3) was somewhat variable. There is some indication that ophthalmoscopic changes occur more rapidly in the older age group (notwithstanding the complication of arteriosclerosis) than in younger patients.

No satisfactory theoretical or practical explanation for this observation can be advanced at this time. Three of the six cases in this group were placed on rutin as prophylaxis for capillary weakness. The Gothlin Index for capillary fragility was normal in all of these patients. The clinical course of the patients on concomitant therapy was to all practical purposes identical with those on dicumarol alone.

Case 3. Occlusion of central retinal vein, partial. Moderate retinal arteriosclerosis. C. M. H., a 72-year-old white man, upon clinical examination of the eyes revealed moderate retinal arteriosclerosis. There was partial occlusion of the central

retinal vein of the right eye with hemorrhages and exudates in the temporal half of the retina. In November, 1944, the vision was 20/200. Eight months later an examination revealed fewer hemor-

1945, a period of six months. For four months the prothrombin activity was maintained at about 50 percent of normal with dicumarol requiring about 500 to 600 mg. per week. The patient tolerated the

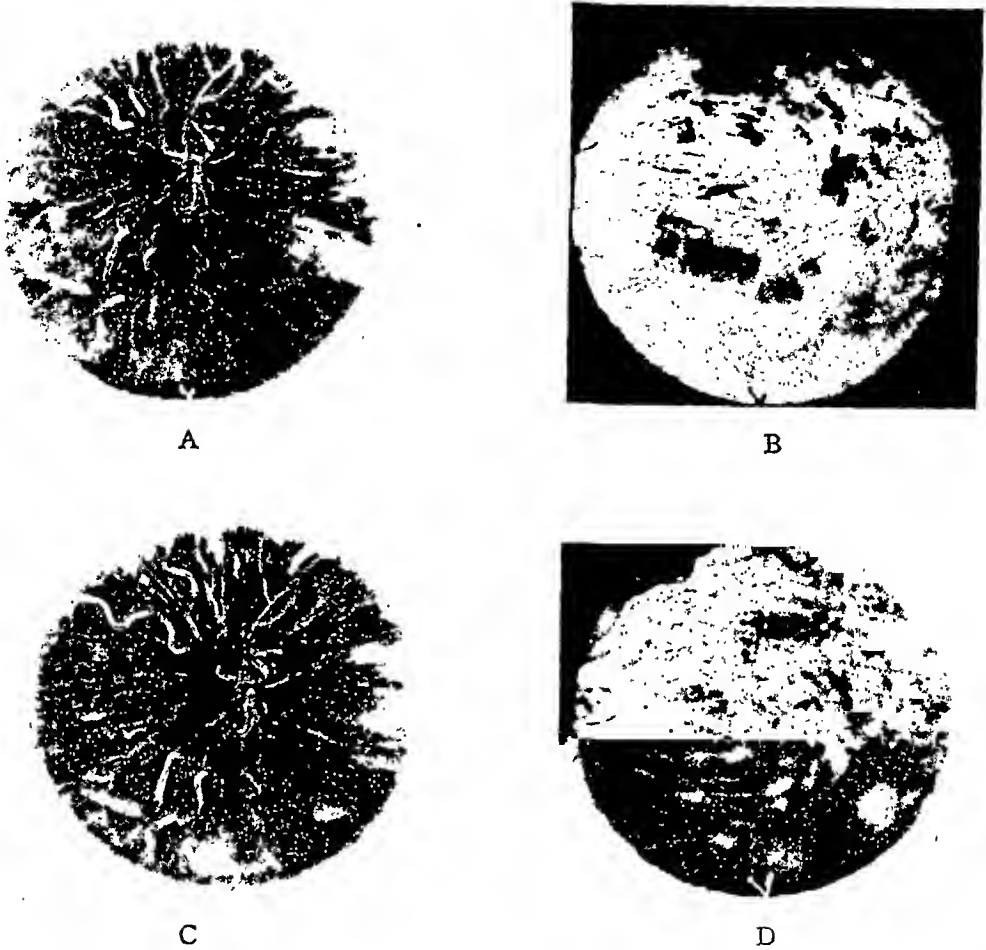


Fig. 1 (MacLean and Brambel). *Case 6. Central vein occlusion.* (A and B). Retinal photographs taken before beginning of treatment with dicumarol and rutin. (A) is a view showing optic nerve and surrounding area with venous engorgement, many large hemorrhages and extensive edema. (B) is a view of the macular and perimacular area showing large blotchy retinal hemorrhages. Hemorrhage and edema obscures the clear view of the retinal vessels. Vision 20/400. (C and D). Retinal photographs taken three months after beginning of treatment with dicumarol and rutin. (C) is the same area as (A), still showing venous engorgement, but hemorrhages are smaller and some absorption has taken place. (D) is the same area as (B), showing some absorption of retinal hemorrhages and a clearer view of retinal pattern. Vision 20/100.

rhages and edema with the vision 20/100.

A determination of prothrombin activity on June 20, 1945, showed a decrease in the clotting time of diluted plasma. Dicumarol administration was started on this date and terminated October 20,

anticoagulant without any side reactions.

The patient was examined ophthalmoscopically in September, 1945. Vision of the right eye was 20/40, and only a few remaining hemorrhages above the macula were found. Slight macular edema was



Fig. 2 (MacLean and Brambel). *Case 7. Central vein occlusion.* (A). Retinal photograph taken before beginning of treatment with dicumarol and rutin. The appearance of the fundus showing engorged veins, hemorrhages and exudates. Vision 20/200. (B). Retinal photograph of same eye taken eight weeks after beginning of treatment with dicumarol and rutin. Only few hemorrhages remain. Vision 20/40. (C). Retinal photograph of same eye taken 10 weeks after beginning of treatment with dicumarol and rutin. The veins have returned to normal size and hemorrhages have practically all absorbed. Vision, 20/30.

noted and the foveal reflex was fair. In December, 1945, vision of the right eye was 20/20, and the retina was completely clear. On May 24, 1946, vision of each eye was 20/20. Ophthalmoscopic examination showed some newly formed tortuous vessels in the right eye above and below the macula. The veins were no longer engorged or enlarged and no hemorrhages were present. A determination of prothrombin activity at this time again revealed a decrease of the clotting time of dilute plasma.

Comment. This patient showed very slow improvement during the eight months preceding anticoagulant therapy. Clinical improvement was more marked after dicumarol administration. The use of anticoagulants was indicated by the increased clotting tendency as manifested by the shortened prothrombin time of diluted plasma. It is of special interest that retinal vascular improvement was noted when the coagulation mechanism was disrupted to 50 percent of normal for four months in an arteriosclerotic patient. There was no evidence of peripheral capillary weakness at any time,

DIABETIC RETINOPATHY

Some of the etiologic factors in diabetic retinopathy may be attributed to vascular sclerosis.² In this respect the use of a readily controlled anticoagulant administered for an indefinite period of time should be helpful in eliminating thrombotic conditions and tendencies associated with the disease.

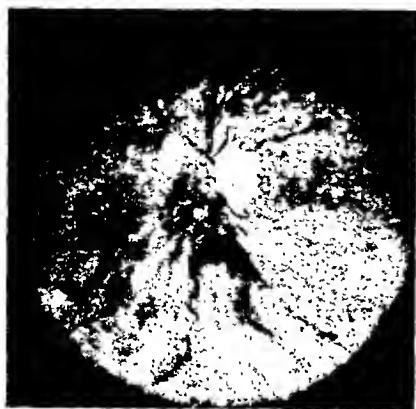
Four cases of diabetic retinopathy (table 1, cases 9-12; see fig. 4) showed improvement of visual acuity and absorption of hemorrhages when treated with dicumarol. No increase in capillary fragility was observed in this group of patients. However, two of four patients were placed on rutin administration simultaneously with dicumarol. Here again, as noted above, the clinical course of the two sets of patients was identical.

The only logical explanation for ophthalmoscopic improvement in our series of diabetic retinopathic patients probably lies in the fact that thrombotic tendencies were inhibited by the anticoagulant with resulting increased vascular efficiency followed by clearing of the involved retina. Also, it is of special significance that

no recurrence of symptoms was noted during course of therapy. The interpretation of this clinical condition on the basis of other etiologic factors must not be minimized. Our present series of cases

and tortuous macular arterioles. There was some edema and exudation in the macular area. Vision in the right eye was 20/50; left eye, 20/20.

A determination of the prothrombin



A



B



C



D

Fig. 3 (MacLean and Brambel). *Case 8. Central vein occlusion.* (A and B). Retinal photographs of nerve and surrounding area showing engorgement of veins, scattered hemorrhages and edema. Taken one month after beginning of treatment. A large flame-shaped hemorrhage is seen below the disc along the course of the lower temporal vessels. Vision, 20/400. (C and D). Retinal photographs taken six months after beginning of treatment with dicumarol and rutin. Views of same areas corresponding to (A) and (B). Practically all the hemorrhages have absorbed. A clearer view of the retinal pattern is obtained showing less venous engorgement. Vision: 20/50.

is too small, and final critical evaluation must await findings from larger numbers.

Case 9. Diabetic retinopathy. Arteriosclerosis, Grade 2. Scattered retinal hemorrhages and exudates. A. C., a 68-year-old white man, with mild diabetes and arteriosclerosis revealed upon ophthalmoscopic examination in November, 1945, scattered pin-point retinal hemorrhages

activity on November 20, 1945, showed a decrease in the clotting time of dilute plasma (56 seconds compared to 85 seconds for the lower limit of normal). Dicumarol administration was started on this date and has been continued without interruption to the present date. This patient has been on continuous anticoagulant administration for eight months with

his prothrombin activity reduced to about 50 percent of normal. The average dicumarol requirement to maintain this level was 300 mg. per week, 100 mg. being taken on alternate days. A total of 5,800

rhages and exudates were observed. On April 15, 1946, the right eye was entirely clear of hemorrhages and exudates in the periphery. Some edema and a few fine pin-point hemorrhagic dots were still

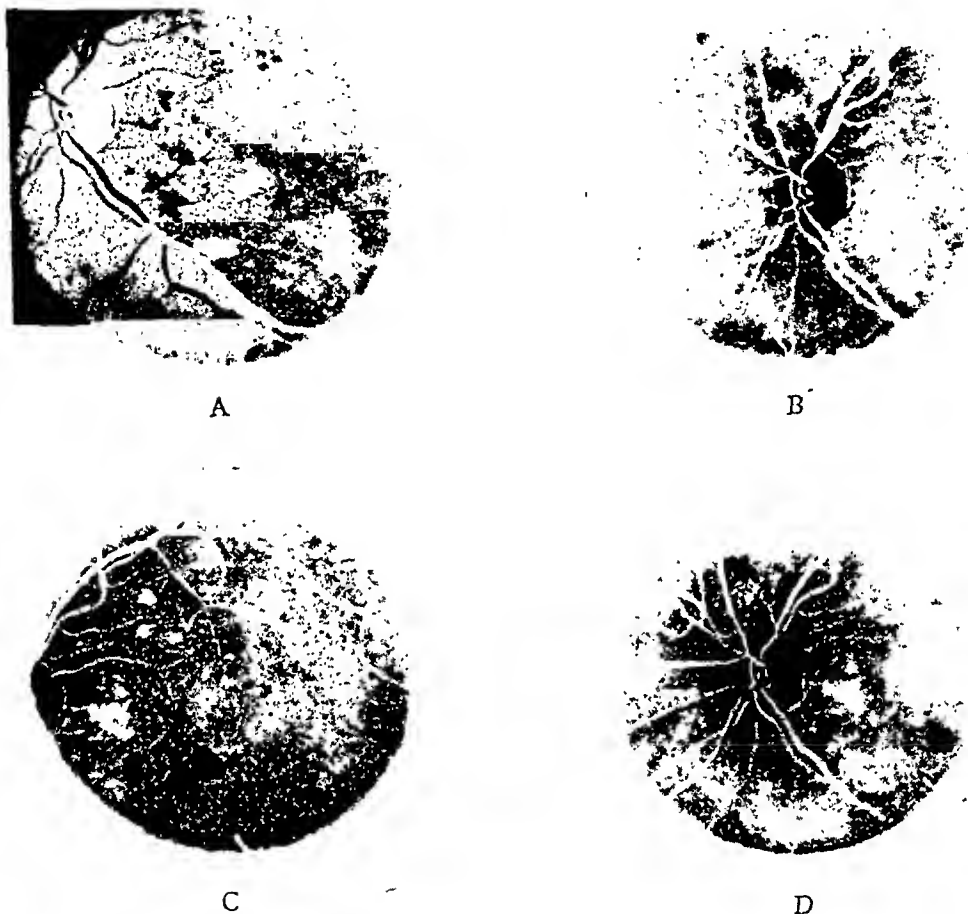


Fig. 4 (MacLean and Brambel). *Case 10. Diabetic retinopathy.* (A and B). Retinal photographs taken on same day three months after beginning of treatment with dicumarol and rutin. Scattered hemorrhages and exudates are seen. (C and D). Retinal photographs of same eye six months after beginning of treatment with dicumarol and rutin. Some absorption of hemorrhages is seen. Vision 20/50.

mg. dicumarol has been administered.

On February 23, 1946, capillary fragility, as determined by the Gothlin test, was negative. However, 40-mg. rutin daily were given orally and continued as of the present date. Rutin was used in this case as prophylaxis for potentially increased capillary permeability.

In March, 1946, vision in the right eye was 20/30; left eye, 20/20. Fewer hemor-

present in the lower part of the macula.

Comment. This patient presenting mild diabetes and arteriosclerosis Grade 2, with scattered peripheral pin-point hemorrhages and generalized edema and exudation in the macula showed some improvement after six months of anticoagulant therapy. The use of anticoagulants was indicated by the increased clotting tendency as manifested by the shortened

prothrombin time of diluted plasma. Although there was no evidence of peripheral capillary weakness, rutin therapy was instituted as prophylaxis. There was slight improvement in vision and gradual but progressive clearing of hemorrhages and exudative processes.

SPASM OF CAPILLARIES

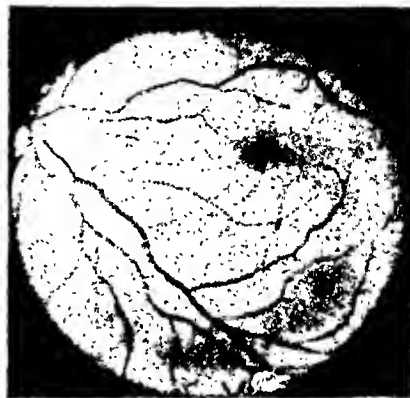
The retinopathic condition manifested by macular and premacular edema with attenuated vessels may be the result of spasm of the capillaries or toxic processes of an allergic etiology.² Two such cases

pairment to explain the clinical condition. This idea is supported by the finding that in a very short time on concomitant anticoagulant and rutin therapy the lesions cleared and normal visual acuity was restored. It is suggestive to presume that toxins in some manner were rendering the capillary beds inefficient, resulting in edema. Also, there may have been some obstruction of capillaries with soft clots. But with the increase in capillary efficiency the inflammatory condition subsided.

It is to be borne in mind that the



A



B

Fig. 5 (MacLean and Brambel). *Case 18. Central serous retinopathy (angiospastic)*. (A). Retinal photograph of left eye one week after beginning of treatment with dicumarol and rutin. Shows marked attenuation of branch of inferior temporal artery leading to macular area and milky white appearance with edema in and below the macula in lower part of the macula supplied by this vessel. Vision 20/40. (B). View of same eye two weeks after beginning of treatment with dicumarol and rutin showing retinal vessel slightly larger with some absorption of edema. Vision 20/30.

(table 1, cases 18-19; see fig. 5) are presented in our series. Ophthalmoscopically both patients showed impaired visual acuity and the other usual signs and symptoms of this condition. Ordinarily, prognosis is relatively favorable in such cases provided the symptoms are of short duration. Both patients were started on combined therapy within a short time after onset.

It is tempting to presuppose that the finding of a decreased clotting interval of diluted plasma compared to normal was a premonitory sign of vascular im-

number of cases is small and further follow-up studies and additional patients will have to be analyzed before a definitive clinical evaluation is possible. It is of special interest that neither dicumarol nor rutin contributed to the toxic condition.

Case 19. Central serous retinopathy (angiospastic). M. M., a 35-year-old white man, upon ophthalmoscopic examination in January, 1946, showed in the right eye an annular swelling surrounded by a ring-shaped light reflex in the macular area and marked narrowing of one of the main arterioles leading to this area.

The vision, which commenced to blur three days previously, was 20/70.

Prothrombin clotting-time determination revealed a decreased clotting interval of diluted plasma. Dicumarol administration was started and the prothrombin activity was maintained at 50 percent of normal for three months. Rutin (60 mg. daily) was given for the last two months.

Comment. In three months the edema subsided. The attenuated arteriole was larger and more normal in appearance, and the vision was 20/20. Five months after onset there have been no further recurrences and medications have been discontinued.

EALES' DISEASE

Two cases of recurrent idiopathic retinal hemorrhage² (Eales' disease) (table 1, cases 20-21) are presented in this series. These patients manifested a strongly positive Gothlin Index. Rutin alone was the drug of choice. Following administration of this flavonal glucoside, improvement in visual acuity corresponded to restoration to normal of capillary weakness.

Case 20. Eales' disease. Perivasculitis with recurrent vitreous hemorrhage and uveitis. E. P., a 60-year-old woman, in June, 1944, developed iridocyclitis in the left eye. View of the fundus was obscured by the vitreous haze. When this cleared, she was found to have a large, whitish chorioretinal lesion temporal to the macula with much perivascular sheathing of the adjoining retinal vessels. There was a mild generalized arteriosclerosis, with the blood pressure 170/95 mm. Hg. Previously, there was a chronic cholecystitis which later became acute, necessitating an emergency cholecystectomy. The intracutaneous tuberculin test was markedly positive up to 1:1,000,000 dilution. She was given tuberculin therapy. There were mild recurrences of the

inflammatory reaction and vitreous haze for almost a year.

In October, 1945, a similar condition developed in the right eye and for five months the clinical course was characterized by recurring attacks of vitreous hemorrhage and uveal inflammation followed by slight clearing of the media with improvement in the vision. In March, 1946, the vision was down to 2/200, and all fundus details were obscured by the vitreous haze. Capillary fragility, as measured by the tourniquet test, was found to be markedly positive. Rutin (60 mg. daily), was started. Following this, improvement was almost dramatic. There was no more vitreous hemorrhage and the existing opacity cleared and absorbed rapidly with vision back to 20/30 in three weeks' time.

Comment. This patient responded very favorably to rutin administration with clearing of vitreous and retinal hemorrhages. It is tempting to presume that the effect of the rutin was to improve capillary integrity sufficiently with the result that an efficient capillary bed in the retina was formed whereby absorption of hemorrhage and vitreous cloud was facilitated.

DEGENERATIVE RETINOPATHIES

The primary etiologic factors for degenerative retinopathies (table 1, cases 13-17; see fig. 6) probably rest upon vascular sclerosis.² Anticoagulant therapy should forestall the secondary process of thrombosis. Improvement of visual acuity has been uniformly obtained in all the patients in this series. Evidence is presented which indicated that anticoagulants have to be administered continuously for an indefinite period of time since cessation of anticoagulant therapy results in regression of symptoms. How advantageous and efficacious such a course of therapy will be remains to be established

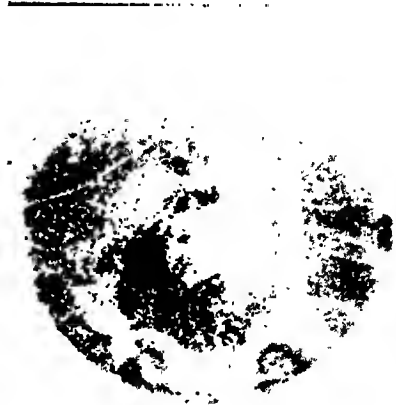
by further ophthalmic study. These findings open a new field of research into degenerative vascular retinopathies.

Case 13. Disciform retinal degeneration, bilateral. E. H., a 56-year-old

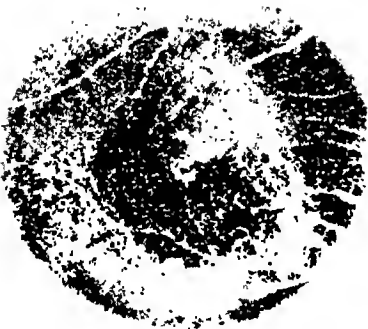
generative macular lesion about a disc diameter in size having the appearance of an arrested Junius Kuhnts' type of degenerative retinitis. The vision was 1/200 eccentric.



A



B



C



D

Fig. 6 (MacLean and Brambel). *Case 13. Degenerative retinopathy.* (A). Retinal photograph of right eye taken one month after beginning of treatment with dicumarol and rutin. This view shows early disclike central retinal degeneration with hemorrhage. Some absorption has taken place. Vision 20/100. (B). Same area as Figure 6A but taken four months after beginning of treatment. Vision 20/40. (C). Same area as Figure 6A but taken six months after beginning of treatment with dicumarol and rutin. This view shows breaking up and some absorption of the crescentic hemorrhage. Vision 20/30. (D). Retinal photograph of the left eye of same patient showing disclike central retinal degeneration of two years' standing. Vision 1/200 eccentric.

woman, noticed blurring of vision of the right eye about three weeks before treatment was started. There was a circumscribed hemorrhagic lesion in the macula, and vision was 20/100.

Five years previously she had what she described as a hemorrhage in the left eye. There was a circumscribed, white, de-

Treatment with dicumarol was started on November 19, 1945, and continued until May 16, 1946. Rutin (60 mg. daily) was started on January 13, 1946, and is still in progress. Prothrombin activity has been maintained at 50 percent of normal, requiring 300-500 mg. per week.

In three months' time the hemorrhage

had cleared from the central macular area, leaving a small crescent-shaped area below the fovea, and the vision had improved to 20/30. In another three months the lesion had cleared entirely and dicumarol administration was discontinued, but rutin therapy was kept up.

One month following the discontinuance of the anticoagulant the vision was again down to 20/70, an ophthalmoscopic examination showed recurrence of macular hemorrhage. Administration of dicumarol was resumed and to date there has been noticeable improvement with the vision 20/50. Ophthalmoscopically, the macular hemorrhage is absorbing. At present, a small crescent-shaped hemorrhage remains below the fovea and there are some pigmentary and cystic changes.

Comment. This patient responded favorably to anticoagulant therapy and when it was discontinued, regression of vision and recurrence of lesions took place. This case illustrates the necessity and efficacy of long-term anticoagulant administration in degenerative types of retinopathy.

CONCLUSIONS

The validity of our conclusions—that dicumarol and rutin possess therapeutic value in venous thrombosis and the absorption of retinal hemorrhages—depends on the admission that the rate of absorption of such blood extravasations in

the patients here reported was greater and more rapid than could have been observed had no treatment been given. Without clinical or laboratory controls, it is obviously impossible to verify this point. It was our opinion, however, that the absorption of the hemorrhages was decidedly more rapid than could have been expected in untreated cases. Especially is this true in the diabetic cases reported.

1. Long-term administration of dicumarol has been used efficaciously in central and tributary retinal occlusion, diabetic, degenerative, and central serous retinopathies.

2. Rutin has been found to decrease capillary fragility and has been used with benefit in recurrent retinal and vitreous hemorrhage.

3. An increased clotting tendency has been observed in all our cases of vascular retinopathies. This is manifested by a decrease in the prothrombin clotting time for diluted (12.5 percent) plasma.

4. Improvement in visual acuity has been accomplished in this series by maintaining the prothrombin activity between 50 and 60 percent of normal up to a period of six months or more.

5. Sufficiently significant results have been obtained to warrant further clinical evaluation of dicumarol and rutin in ophthalmology.

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RECESSION OF LIMBAL CONJUNCTIVA

AN OPERATION FOR TREATMENT OF TRACHOMATOUS PANNUS

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Trachoma, still a widespread disease, a personal or family stigma, a social plague where prevalent, is always an interesting subject, however considered. Early superficial pannus and its accompanying ulcers make the sufferer an invalid for recurrent periods of time, and its degeneration into the thick, persistent, and richly vascular pannus of the entire cornea causes severe impairment of vision, and, if equally developed in both eyes, produces chronic, perennial invalidism. The treatment of pannus varies from the local application of drugs to the simple, conservative, or more or less radical operative procedures.

I would like to describe herewith a surgical method which I have been performing in severe and persistent cases of the disease.

OPERATIVE PROCEDURE

A lid speculum, two fixation forceps, a double fixation forceps, a curette, a cataract knife, a needle holder, and six double-armed sutures of No.-3 braided silk are needed for the operation.

Infiltration anesthesia of lids and upper and lower fornices is usually sufficient. General anesthesia is employed in unruly patients.

After the usual preoperative local preparations have been made, the speculum is inserted and the conjunctiva is circumcised as close to the limbus as possible (fig. 1) and then dissected all around to the limits of the fornices (fig. 2). The subconjunctival tissue is now carefully removed for about 6 mm. around the limbus, leaving a bare, clean sclera. The remnant of the conjunctiva at the limbus

is curetted away, and the blood vessels in the cornea still full of blood are split with the point of a cataract knife. The specu-

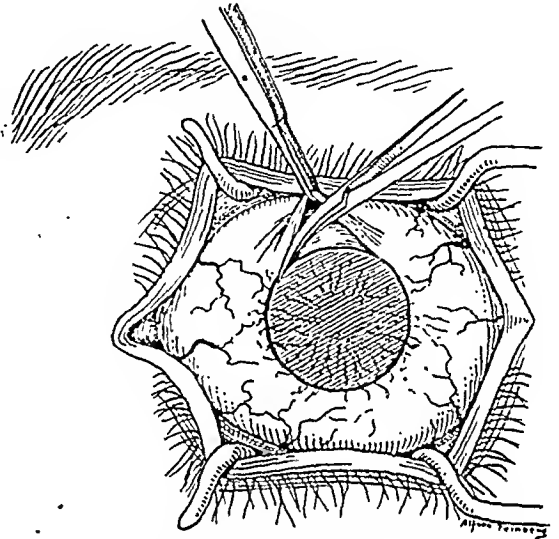


Fig. 1 (Lombardo). The conjunctiva is circumcised as close to the limbus as possible.

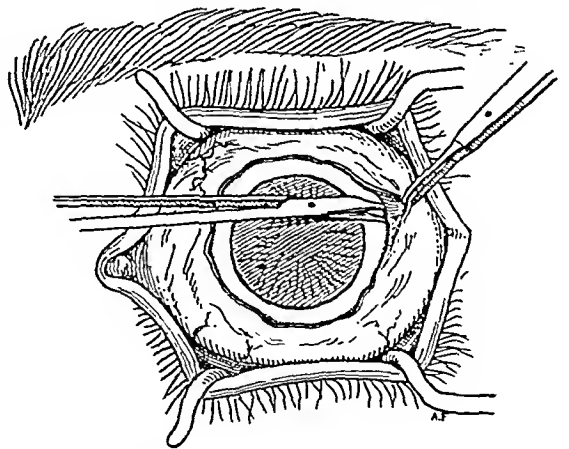


Fig. 2 (Lombardo). The conjunctiva is then dissected all around to the limits of the fornices.

lum is now removed and a suture is applied as shown in Figure 3-C, using the following procedure.

While the upper section of the con-

junctiva is held and everted by a double fixation forceps (fig. 3-a) one needle of the double-armed silk suture is inserted in the scleral side of the conjunctiva at

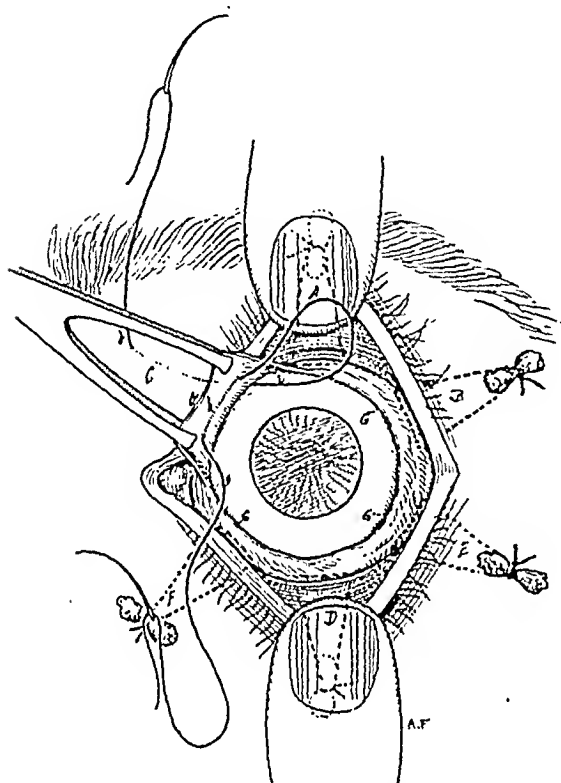


Fig. 3 (Lombardo). Suturing technique in the operation of recession of limbal conjunctiva.

about 10 mm. from its margin (fig. 3-b), passed parallel to it for about 6 mm. without perforating the membrane, is brought upward between the conjunctiva and the sclera (fig. 3-C) and then out through the skin below the brow (fig. 3-D). The other end of the suture (fig. 3-e) is carried up and brought out near the first end, care being taken that the two ends of the suture come out in a converging direction. The ends of the suture are now pulled out making traction on the cut margin of the conjunctiva until this is recessed to about 6 mm. from the limbus and are then knotted on a small roll of gauze. The same procedure was followed on applying all sutures.

Figure 3, at A and B, shows the su-

tures properly inserted in upper lid and the conjunctiva recessed from the limbus upward, as well as the two ends of each suture knotted on the roll of gauze below the corresponding section of the brow.

Figure 3, at D, E, and F, shows three other equidistant sutures inserted similarly in the lower section of the conjunctiva and brought out near the corresponding lower margin of the orbit. Figure 3 also shows, at G, how the incised margin of the conjunctiva has been recessed all around at an even distance from the cornea.

After all sutures are applied the conjunctival sac is irrigated with bichloride of mercury solution (1:5,000). Bichloride of mercury ointment (1:5,000) is applied, and the eye is bandaged. The eye is

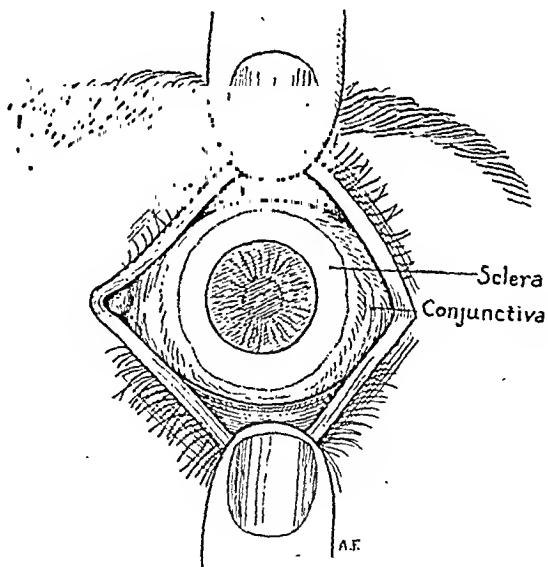


Fig. 4 (Lombardo). The appearance of the eye after the sutures have been removed.

dressed every day, and the sutures are allowed to remain in place until the sclera is seen to be covered by epithelium.

The resulting appearance of the eye after the removal of the sutures is represented by Figure 4.

DISCUSSION

Recession of conjunctiva to treat pannus consists essentially in the permanent fixation of the incised limbal margin of conjunctiva away from the cornea. It is a new operative method based on the principle that the abnormal blood vessels of the cornea are to be properly and per-

hyperplastic limbus. The advancing terminations of the small vessels appear to be surrounded by a grayish infiltration of lymphatic elements or to converge towards zones of avascular infiltration. These observations lead one to think that blood vessels either represent the originator, the prime pathogenic manifestation,

TABLE 1

RESULTS OBTAINED FROM THE RECESSION OF LIMBAL CONJUNCTIVA FOR
TREATMENT OF TRACHOMATOUS PANNUS

Case Number	Sex	Age of Patient	Eye Operated	Form of Pannus	Vision Before Operation	Vision After Operation	Condition of Cornea After Operation	Inflammatory Relapse
1	M	23	L	Densely vascular	5/200	20/70	Only faint thin opacities remain affecting the corneas and their pupillary areas, which, becoming more or less transparent, make the vision of these eyes restored in proportion.	None
2	F	34	R	Densely vascular	L.P.	20/100		None
			L	Densely vascular	c.f. at 3 feet	15/200		None
3	M	28	R	Slightly vascular	10/200	20/70		None
4	M	29	R	Densely vascular	L.P.	20/100		None
			L	Slightly vascular	8/200	20/100		None
5	F	26	L	Thickly vascular	L.P.	10/200		None
6	F	32	R	Slightly vascular	c.f. at 3 feet	20/70	Only faint thin opacities remain affecting the corneas and their pupillary areas, which, becoming more or less transparent, make the vision of these eyes restored in proportion.	None
			L	Slightly vascular	10/200	20/100		None
7	M	34	R	Slightly vascular	10/200	20/50		None

manently eliminated in order to cure the pannus.

Biomicroscopic observations on beginning trachomatous pannus by M. Vele, A. Busacca and others reveal the presence of capillaries running in the superficial layers of the cornea mostly in the upper section of this structure. The capillaries are seen to spring from the blood vessels of the conjunctiva and to reach the cornea through a somewhat

and the nutritive element of the pannus, or that they are at least essential to its formation, completion, and maintenance. As a consequence, the course of these blood vessels must be permanently discontinued, if the pannus is to regress and disappear.

It has been noted that if the conjunctiva is circumcised at the limbus, a marked ischemia and consequent paleness and thinning of the pannus manifest

themselves. Both of these conditions persist if the conjunctiva is prevented from reattachment to its original position. When reattachment takes place, the ischemia is rarely followed by the disappearance of the pannus, but in most cases the blood vessels reappear in the cornea, the pannus reforms, and the previous condition relapses and persists. This disappointing result has not occurred in the cases in which the operation of conjunctival recession has been performed.

Observation of the different steps of the operation and its postoperative course emphasizes these points: (1) While performing the operation, we incise the conjunctiva around the cornea and at the same time sever the conjunctivo-corneal blood vessels, thus cutting the main blood and nutrition supply to the pannus. (2) By recessing and fixating the incised margin of the conjunctiva at some distance from the limbus, the reformation of the blood vessels in the cornea is rendered impossible. Since the blood vessels of the recessed conjunctiva become terminal-like, their previous terminations in the cornea become bloodless and in time atrophy. (3) This condition will be permanent, since the conjunctiva is permanently fixed to the new position.

It is worthy of remark that the conjunctiva, which the sutures hold far from the limbus at the time of the operation, will later, when the sutures are removed, be held in place by cicatricial bands formed along the wound channels. These bands unite the conjunctiva to the skin. Other cicatricial bands produce adhesions between the scleral surface of the conjunctiva and the underlying tissue, and there will be an all-around adherence of the incised margin of the conjunctiva to the sclera. In addition, the epithelium, coming from the borders of the wound, will cover the bare sclera shortly after the

operation and will prevent the conjunctiva from sliding along and becoming reattached to its original place.

The following advantages of the operation have been noted: (1) There is a permanent disappearance of the blood vessels from the cornea and consequent recovery from the pannus. (2) More or less clearing of the corneal opacities takes place. The cornea becomes more transparent and vision is improved. (3) The ulcerative relapses of the cornea, which affect recovery from the distressing symptoms of the trachoma, are ended. (4) Shrunken fornices are deepened. It should be pointed out here that in old trachoma the conjunctival fornices are eventually contracted and the upper one is exceedingly shallow if the mucotarsal resection has been performed. Evidently, if the cut margin of the conjunctiva is recessed for several millimeters and the entire membrane is displaced from the limbus towards the fornices, these fornices will become correspondingly deeper, and the relation between the eyeball and the eyelids will be improved.

SUMMARY

The vascularization of the cornea represents the only or the principal element of genesis and nutrition of the pannus. The permanent elimination of the blood vessels from the cornea is the best means to effect a cure, and the recession of the conjunctiva does this. The operation consists essentially in a permanent fixation of the circumcised margin of the limbal conjunctiva away from the cornea. By this means one can obtain permanent disappearance of the pannus, permanent improvement of the visual conditions, the end of corneal ulcerations, and a deepening of the fornices. These satisfactory results have been obtained in all operated cases. The social significance of these results is evident.

142 Joralemon Street (2).

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THE ORTHOPTIC TREATMENT OF THE VERTICAL MOTOR ANOMALIES*

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This paper is the result of the study and treatment of 67 cases of vertical squint, most of which were complicated by a lateral squint (table 1). Since there is still much to be learned regarding the functional origin and the neurologic background of vertical motor anomalies, the data obtained in this study is not conclusive.

The neurologic "question mark" of squint is a fascinating subject. We are only beginning to understand its importance in the motor disabilities¹ of the eyes. Further research and investigation of the neurologic factors involved are required. We should think of the neurophysiology and neuro-anatomy of the motor apparatus in addition to the physical and physiologic action of the extraocular muscles.

The findings in these 67 cases and the results of their treatment make clear the need for treating orthoptically the vertical motor anomalies whose origins are

functional as well as those in which there are lateral deviations.

Correct diagnosis is the first and most important step in initiating treatment.² No therapeutic measures should be instituted without ascertaining whether the cause is functional or anatomical, the exact nature of the existing condition, and the prognosis. The terms, right hypertropia or left hypertropia, do not constitute a diagnosis; neither do the terms paretic right or left hypertropia.

TYPES OF VERTICAL DEVIATIONS

There are five types of recognized vertical deviations:

1. *Concomitant.*³ An essential or mechanical vertical deviation in which the hypertropia or hyperphoria is the same in all the cardinal fields of gaze, with or without correction of the refractive error.

2. *Vertical deviations due to nuclear and infranuclear paresis.*⁴ A condition in which the vertical deviation is maximum in the field of the elevating or depressing action of the paretic muscle.

3. *Vertical deviations due to supranuclear paresis.*⁴ Those deviations, affecting the associated movements of the eyes,

*Read before the Orthoptic Symposium, American Academy of Ophthalmology and Otolaryngology, Palmer House, Chicago, October 13, 1946. From the Department of Ophthalmology, The George Washington University, School of Medicine, Washington, D.C.

TABLE 1
STUDY AND TREATMENT OF 67 CASES OF
VERTICAL SQUINT

	Number	Percent- age
Cases with only one type of hypertropia	43	64.5
Cases with more than one type of hypertropia	24	35.5
Cases complicated with a lateral tropia	56	83.5
Cases without horizontal tropia	11	16.5
Improved with orthoptic training	51	76.1
Unimproved with orthoptic training	12	17.9
DIAGNOSIS		
Concomitant hypertropia	4	6.0
Paretic hypertropia	16	24.0
Pseudo-paretic hyperphoria	2	3.0
Dissociated vertical divergence	23	34.0
Dissociated with paretic hypertropia	18	27.0
Dissociated with pseudo-paretic hypertropia	2	3.0
Intermittent squint in adolescents	3	
TREATMENT		
Postoperative treatment of vertical anomaly	8	13.0
Cases with no fusion before training	21	35.0
Cases treated surgically	15	16.0
Neurogenic cases	35	56.0
Amblyopia cases	32	53.0
Improvement without orthoptic training	4	6.5
Cases with vertical squint in which there was a complicating lateral squint where the treatment for vertical took precedence	26	43.0

which are caused by a weakness or paralysis originating above the motor nuclei in the pyramidal tracts or in the cortical centers. Since these types do not enter into the realm of orthoptics, they will not be discussed.

4. *Pseudoparetic hyperphoria.*⁵ This is a primary overfunction of one or both inferior obliques. This is believed to be due to absence of check ligaments.

5. *Vertical deviations of dissociated type.*⁶ These may be brought about by increased or abnormal innervations or by excitations from the centers of vertical divergence. These types are generally as-

sociated with other nervous factors unrelated to the eyes and are present in most cases of poor fusion as well as in cases of high degrees of esotropia and exotropia. They are usually present after surgical treatment of a vertically acting muscle.

TESTS FOR DIAGNOSIS

In our studies of the vertical motor anomalies, we have found that no one test is sufficient to make a diagnosis. One cannot make a final diagnosis on the findings of the prism and cover test alone. By the same token the diplopia tests cannot be used as the only basis for the diagnosis. The diplopia tests are valueless and misleading in cases of abnormal retinal correspondence, or when the innate directional value of retinal elements has been changed. Before any therapy is instituted, these preliminary measures are necessary:

1. A careful history should be taken.
2. A study of the general neurologic condition as well as the general physical and psychologic status of the patient should be made.
3. The results of the different tests—visual, refractive, the fixating eye, measurements in the cardinal fields of gaze as well as in the primary position—should be summarized. When a double hyperphoria is present (a right and left hyperphoria) these measurements should be made with each eye fixating.
4. There should be a careful study of the eye movements to determine whether (a) they are of the quick, regular movements in up and down excursions, such as are seen in the concomitant and in the recent or partially recovered paretic types of vertical deviations; (b) if they are of the over-shooting type, moving too far in the direction necessary for fixation, then making a quick movement in the opposite direction to accomplish foveal fixation; (this type of movement is often

noted after surgery on one or more of the extraocular muscles and sometimes in paresis of one or more of the extraocular muscles when the paresis is in a late stage and the contractures and overactions of the agonist and antagonist muscles are very excessive); or (c) if they are the slow, oscillating type of movement, sometimes accompanied by a wheel-like rotation, typical of the dissociated vertical deviations.

5. It should be determined whether or not the vertical squint is constant or intermittent.

6. The fusion status should be checked. If little or no fusion is present, a surgical procedure will result in little or no correction of the squint in almost every case. If fusion is present,⁷ the vertical, as well as the lateral fusion amplitudes, and the cyclovergences must be measured.

7. A correct diagnosis must be made.

To our knowledge, the troposcope is the only type of major amblyoscope that permits correction of high degrees of hypertropia, such as are found in the dissociated vertical disturbances. This is important because it is necessary to start at the angle of deviation and build up the fusional amplitudes from that point, just as one does in the lateral deviations. If there is a large degree of dissociated vertical deviation, it must be corrected at its maximum angle on the instrument. The vertical separation of the objects is gradually reduced. This teaches the patient to hold the images of the two eyes fused and is continued until he can easily fuse without any prismatic correction or without any vertical separation of the visual axes. A vertical prism ladder can also be used. These procedures teach the patient voluntary control of the vertical squint and give him an appreciation of diplopia at the vertical angle. This is especially true when dissociated vertical disturbances are present, because these patients do not appre-

ciate vertical diplopia unless taught to do so.

We have found that fusion training before and after surgery on a vertically acting muscle is a necessary therapeutic procedure. During the first week or 10 days after surgery, there are many abnormal innervations activating these muscles. These innervations may produce a high overcorrection one day; the next day there may be no deviation; then on a succeeding day, there may be a definite undercorrection, followed again by an overcorrection.

These variable findings make it most difficult to know how much benefit has been obtained surgically. Daily orthoptic observations and guarded fusion training during this period usually reduces or controls the abnormal innervations for as long as the fusion impulse takes precedence. Thus, in a very short time, the surgeon can objectively verify the amount of correction that has resulted from the surgical procedure and save the patient anxiety during those months following the surgery when abnormal innervations create such diverse amounts and types of deviation with accompanying diplopia.

A retention suture, which can be loosened or tightened from day to day, will enable the surgeon to get a very accurate result, if he can determine what amount of vertical deviation is innervational and what is mechanical or anatomic. If an orthoptic routine of fusional training and observation, including the vertical divergence fusional amplitudes, is instituted a few days after the operation, it will aid the surgeon in determining these factors.

CONCOMITANT HYPERTROPIA

In concomitant hypertropia, (hyperphoria or tropia) the amount of vertical deviation is approximately equal in the whole field of fixation, with or without glasses. This is corroborated by the prism

and cover tests and the diplopia tests which correspond in their measurements and are constant.

Often fusion training will relieve the patient of his symptoms, if the hyperopia is of low degree, but it will not correct the hyperopia. Teaching a patient to overcome a low degree of hyperphoria can be done as easily as teaching a patient to overcome an esophoria or an exophoria by increased fusional stimulus.

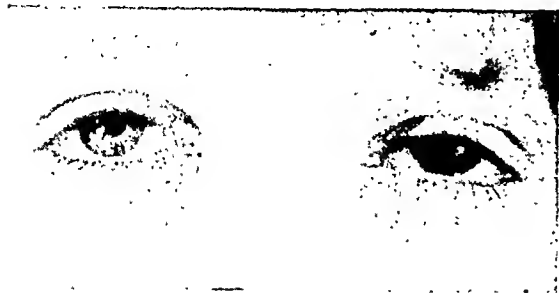


Fig. 1 (Kramer). *Case 1.* Divergent strabismus of the right eye, with divergence excess and convergence insufficiency. This was the result of an accommodative convergent squint which was overcorrected by glasses. The divergence excess was a probable etiologic factor in the accommodative convergent squint. The divergent squint was cured surgically. The concomitant hyperphoria was relieved orthoptically but not cured.

This is done by stimulating the innervations from the opposite center of vertical divergence; that is, if a patient has a right hyperphoria, the negative fusional vertical divergence is stimulated and strengthened. In other words, the negative vertical divergence is restricted in its fusional range to the same extent that the fusional range of the positive vertical divergence amplitude is enlarged. Stimulation of the vertical divergences is accomplished on the major amblyoscope and the vertical prism ladder; however, there is a limit of the fusional range beyond which it is impossible to enlarge. Usually the patient has to be trained to utilize the maximum innervation obtainable, thus enabling him to hold the visual axes level rather than

to permit one eye to deviate higher or lower than the other.

Attention should be given to the lateral fusional range. This also must be stimulated to its maximum, allowing the patient to utilize the increased fusional innervations to hold the visual axes in proper position for the maintenance of comfortable, single binocular vision. The degree of esophoria or exophoria will determine to what extent the vertical deviation can be overcome in a diverging or converging position. If an exophoria be present, binocular single vision will be more difficult to maintain in a converging position. In cases in which a strong impulse to fusion is present and in which high lateral amplitudes are easily attained, prism correction for constant wear is not required. However, neuropathic types and cases with weak fusion do not respond well to orthoptic treatment. Cases are selected upon this premise. In the higher degrees of hyperphorias and tropias, prism correction is indicated if surgery is not done.

CASE REPORT

R. E., a boy, aged five years, was first seen in Dr. Sheppard's clinic on October 30, 1939. The diagnosis was: convergent squint (O.D.) accommodative. After occlusion of the right eye for amblyopia, there was a divergent squint (O.D.) for distance and near. The right hyperphoria was concomitant (fig. 1). The report of the ophthalmologist who had seen this patient previously follows: "Patient was first seen March 24, 1939, with a right esotropia of 20 degrees with the following correction: O.D., +5.50D. sph. \ominus +1.00D. cyl. ax. 90°; O.S., +5.50D. sph. \ominus +0.75D. ayl. ax. 90°. Amblyopia right eye, with uncertain fixation, vision reduced to 20/100. The vision was 10/10 in the left eye. After occlusion of left eye for four weeks, he developed an am-

blyopia in this eye and an exotropia. Responded very well to orthoptics, vision became almost equal and eyes are straight with correction." This history was corroborated by the mother.

On October 30, 1939, the boy's vision was, 20/40, each eye, for distance and near, without correction. Because of his accommodative convergent squint, the vision, with both eyes straight, was only 20/100.

The Pcb was remote. There was an exotropia for near and distance with correction. Without correction he was seen to turn in the right eye fleetingly. He was wearing the correction prescribed by the ophthalmologist who had seen him previously. Without correction, with the prism and cover test, he measured orthophoria for distance and near; with correction, exotropia for distance, 10 to 18 diopters; exotropia for near, 6 diopters; with right hyperphoria, 2 to 4 diopters. His fusional amplitudes seemed normal. He left Washington with his parents and did not return until July 2, 1942. At that time his vision was: O.U., 20/70, without correction. He was wearing 1-diopter less hyperopic correction (+4.50D. sph: with cylinders) for each eye. On the synoptophore, with correction, he measured exotropia, 18 diopters; right hyperphoria, $2\frac{1}{2}$ diopters. He had no convergence fusional amplitude and a fusional divergence of 20 diopters. Under atropine he measured, prism and cover test, exotropia, 15 diopters for distance; exotropia, 15 diopters for near with right hyperphoria, 2 diopters. He was given the following prescription: O.U., +1.00D. sph. \ominus +2.50D. cyl. ax. 90° . He had a marked fusional instability with the reduced correction because of the right hyperphoria. He also had a constant diplopia.

On September 14, 1942, he was given the following correction: O.D., +2.50D.

cyl. ax. 90° , 3D. prism, base-down; O.S., +2.50D. cyl. ax. 90° .

Since the amblyopia in the right eye had returned, occlusion by covering the lens of the glasses with nail polish was prescribed. On November 24, 1942, a Jameson recession of 4 mm. was performed on the right lateral rectus. On December 4, 1942, the prism and cover test showed: Without correction, orthophoria for near and distance; right hyperphoria, $\frac{1}{2}$ diopter. With correction, orthophoria for distance; exophoria for near, 10 diopters; with left hyperphoria, 2 diopters. This latter finding indicated that the right hyperphoria was overcorrected by the 3-diopter prism, base down, in front of the right eye in his glasses. The Maddox-rod test showed: with correction, no lateral deviation, near and distance, right hyperphoria, 3 diopters. He was advised to go without glasses if he wished, and orthoptic training directed to the convergence was started.

This boy was very phlegmatic. The convergence never became good (30 diopters on the synoptophore), probably because the mental effort necessary to utilize the voluntary fusional impulses was inadequate. However, he could wear his astigmatic correction without prism correction of the right hyperphoria, could bar read well, could maintain an orthophoric position on the hand diploscope, and was perfectly comfortable when last seen on December 27, 1945. On the Worth 4-dot test he had fusion for both distance and near, without correction.

PARETIC HYPERTROPIA

The treatment of a paretic hypertropia is not orthoptic, but medical and surgical. Fusion training is often highly beneficial in recovered cases of pareses in that it aids in balancing the innervations to the antagonist and yoke muscles and makes for better coordination of the two

eyes in binocular vision. If the lateral fusional amplitudes are normal, orthoptic training should be directed to enlarging the vertical divergence amplitude that is deficient or restricted. After this the so-called "dissociation" exercises are given. This includes the diploscope, Remy separator, "hole in hand," and triple bar reading. In some cases of anisometropia or unequal vision, or in cases where there is a highly dominant eye, a red glass to be worn over the better or dominant eye (red kodaloid combined with a smoked glass) is given for reading and studying.

CASE REPORT

D.K., a boy, aged 12 years, was seen because of a paresis of the left inferior rectus. Vision was: O.D., 20/15, with a +0.50D. sph. \ominus +0.50D. cyl. ax. 160°; O.S., 20/15, with a +1.00D. sph. \ominus +0.25D. cyl. ax. 60°, 3½D. prism, base-down. Vision without correction was: O.D., 20/20-iii; O.S., 20/15.

When first seen on December 12, 1944, he had a head tilt, rotated to the left and depressed, and a left hypertropia of 54 diopters. Orthoptic training was directed to building up the positive fusional vertical divergence amplitude and overcoming the suppression of the right eye which existed without the correction. After three months of orthoptic training, he was perfectly comfortable and did not admit of any diplopia except when making an effort to obtain it in the primary position. The vision in the right eye improved to 20/15-i, without correction. He was within normal limits on the Howard Dahlman depth-perception test and had stereopsis on the orthoptic instruments. The amount of left hyperphoria had not diminished, but he was most happy that he did not have to wear glasses. Only surgery will correct the condition and since he wishes to become a pilot, surgery is indicated. We did not have an opportunity to ob-

serve him further as he moved elsewhere. However, his present ophthalmologist reported on October 13, 1946, that he is still doing fine.

PSEUDOPARETIC HYPERPHORIA

This type of hyperphoria is easily diagnosed even in a cursory examination. The adducted eye, being in the field of action of the overacting inferior oblique, deviates upward. There is no deficiency of the superior oblique of the same eye, its antagonist, nor of the superior rectus of the opposite eye, the agonist or yoke muscle, as verified by the diplopia tests and the rotations. If the hyperphoria is bilateral, it is present on dextroversion and levoversion. It is not present in the primary position except when combined with a paretic or dissociated type of vertical deviation.

No orthoptic treatment is indicated unless the patient is having symptoms, as there is no vertical deviation in the primary position. However, the majority of vertical phorias of pseudoparetic origin have a coexisting lateral or vertical component. We find a fair percentage of accommodative convergent strabismus patients with a complicating pseudoparetic hyperphoria. With the correction and cure of the lateral squint, the pseudoparetic hyperphoria disappears. This may be explained by the fact that many accommodative squints have a very marked inshoot of the deviating eye, which, with the absence of check ligaments of the inferior oblique, give this muscle predominance in an eye that is excessively adducted over a period of time.

More frequently do we find pseudoparetic hyperphoria present in those cases of accommodative convergent strabismus with a small amount of hyperopia, with or without anisometropia, particularly in patients with a marked neurogenic background.

These cases should, perhaps, be placed in another classification rather than in the accommodative group. When tested monocularly, the accommodation is normal for the age of the patient. When tested binocularly, it is extremely subnormal, and the binocular vision for near may be as low as 20/800 on the Lebensohn chart. The initial treatment in these cases is the same as in a true accommodative convergent squint; that is, full correction of the refractive error, however small, with an additive of +3.00D. sph. bifocals for near. Relieving the accommodation with plus lenses seems to relieve the other innervational factor, which is the primary cause of the lateral squint and it may possibly relieve the pseudoparetic hyperphoria. If we had an accurate and factual knowledge of the cortical centers and their interconnecting pathways, our empiric knowledge would be greatly enhanced and the treatment and cure of our patients more effective and rapid.

CASE REPORT

J. McP., a girl, aged six years, came to us on November 18, 1942, because of an alternating convergent squint, 25 percent mechanical and 75 percent accommodative. Heterochromia and pseudoparetic hyperphoria were also present.

The history indicated that she had had a convergent squint of the left eye for the preceding $3\frac{1}{2}$ years. She was wearing a correction of +3.50D. sph. for each eye. The punctum proximum of accommodation was 9 cms., each eye, without correction, which was normal for her age and refractive error. Vision was: O.D., 20/30-i; O.S., 20/30+i, without correction. The prism and cover test showed: Accommodative esotropia 35 diopters for distance; esotropia for near, 40 diopters without correction. Not accommodating, under atropine, esotropia 3 diopters for

distance; esotropia for near, 20 diopters with correction and with a +3.00D. sph. added for the near measurement.

There was no hyperphoria in the primary position but an overaction of both inferior obliques when either eye was adducted. The following glasses were prescribed: O.D., +3.50D. sph. \ominus +1.00D. cyl. ax. 70° ; O.S., +2.75D. sph. \ominus +1.50D. cyl. ax. 85° .

Because of the intermittent squint for near and blurred vision with both eyes straight for near, the patient should have been given +3.00D. bifocals for near work. With glasses, O.U., eyes straight, she read 20/40 for distance and only 20/100 for near. Because of this, she did not do well when the orthoptic training was started in January, 1943, as it was too difficult for her to clear her vision even with the full distance correction, and the squinting for near vision continued. She was not too enthusiastic about the orthoptic training and the coöperation was not good, especially on the home training. On October 24, 1943, a Jameson recession of the left medial rectus (4 mm.) was done, with excellent result. Six days later she read, with glasses, O.U., straight, 20/20-ii, distance, and 20/25-ii, Lebensohn, for near. She had no alternation and maintained binocular single vision. Consequently the glasses were reduced to: O.D., +1.50D. sph. \ominus +1.00D. cyl. ax. 70° ; O.S., +0.75D. sph. \ominus +1.50D. cyl. ax. 85° .

Dissociation exercises were instituted with the continuation of amplitude training. Glasses were eliminated for outdoors. On February 4, 1944, she again had an intermittent convergent squint with glasses. Vision in both eyes, with correction, was 20/30 for distance and 20/200, Lebensohn chart, for near. With both eyes, without correction, the vision was 20/200, distance, and 20/400, Lebensohn, near. A +1.00D. stronger correction was

then prescribed. Several attempts were made to cure this case but all were unsuccessful. Finally on May 6, 1946, bifocal glasses were prescribed: O.D., +1.50D. sph. \ominus +1.00D. cyl. ax. 70°; O.S., +2.00D. sph. \ominus +1.25D. cyl. ax. 85°; with special +3.00D. cemented bifocals added. The accommodation was normal for her age, 7 cms. each eye, with correction. The fusional convergence was low, the fusional divergence normal. The vertical divergence fusional amplitudes were normal, 4 diopters each; the near point of convergence was normal, 5.5 cms. The squint was intermittent with and without glasses. Vision was: Without correction, 20/50 each eye; with correction, 20/15-ii each eye. O.U., without correction, 20/70-i, distance; 20/100, near; with correction, 20/40, distance; 20/65, near.

At that time the psychologic situation in the home had improved (antagonism between mother and child), and the child became much more coöperative. After the bifocals had been worn, there was a marked improvement in the general nervous condition and progress became steady.

When last seen on September 9, 1946, she was wearing the reduced distance correction for near work only and could do most of the dissociation exercises, with some difficulty in clearing the vision. The pseudoparetic hyperphoria had entirely disappeared. The near point of accommodation was 7.5 cms. each eye, without correction, and fusion for near and distance was present, without correction, on the Worth dot test. She could partially clear the orthophoric position on the diploscope and could clear transparencies on the Remy separator. The vision, O.U.; eyes straight was: 20/20-iv for distance; 20/65 for near, without correction. With correction near vision O.U. was 20/30.

Pseudoparetic hyperphoria was not the

big factor in this case. However, the case does demonstrate that pseudoparetic hyperphoria in an accommodative convergent squint may be a more disturbing condition than is indicated and that it may, perhaps, have the same etiology if the refractive error is low, and the accommodation normal.

DISSOCIATED VERTICAL DIVERGENCE

This type is the most amenable of all the vertical motor anomalies to orthoptic treatment. It is easily recognized by its variability in type and amount, varying from a positive to a negative vertical divergence of greater or lesser degree. The position of gaze does not affect the degree; the fixating eye determines the type. If the right eye is fixating, there is a left hypertropia; if the left eye is fixating, there is a right hypertropia (providing the impulse to fusion cannot bring the deviating eye back to normal position). It is believed to originate in the cerebral centers for positive and negative vertical divergence in the region of the superior colliculi.⁸ Abnormal excitations bring about these varied deviations. The type of deviation depends upon the center innervated, and the amount upon the strength of the impulse or stimulus and upon the amount of illumination entering the eye. It is readily recognized by the slow, oscillating movement of the eye which has been covered or darkened with an optical wedge. With the red-glass test, the red image is lower no matter whether the red glass is held in front of the right eye or the left eye. Bizarre findings are characteristic of the diplopia tests. No matter how often these tests are made, the findings may differ widely on each test. With the increased darkening of one eye, the observer will note this eye making slow pendulous movements upward. As the darkening is decreased, the same slow, oscillating movements downward, often

accompanied by a wheel-like movement can be seen. The patient subjectively notes that the image seen by the eye which is darkened moves down farther and farther, indicating the upward deviation of the eye. As the darkening is gradually decreased, the image slowly moves up, indicating the downward movement of the eye, until the eye and image are horizontal with the opposite eye and image.

There is a general nervous instability present in most cases of dissociated vertical divergence, with or without a lateral component. Often there are abnormal physical conditions and psychologic maladjustments. Although of normal or even above normal intelligence, these patients frequently have a personality handicap which makes it difficult for them to get along with their own age group. However, they are either charming extroverts or interesting introverts.

CASE REPORT

S. McE., a boy, aged six years, was first seen on June 6, 1946, because of bilateral, dissociated vertical divergence and amblyopia ex anopsia of the left eye. He had had a resection of the left lateral rectus (10 mm.), and a recession of the left medial rectus (4 mm.) on March 9, 1945, by an Army surgeon, before he came to live in Washington. The convergent squint had been present since birth, and there was a family history of convergent squint. (The mother has a divergent squint of the right eye at this time, but states it was convergent all of her life until one year ago, when it began diverging, probably due to eccentric fixation and amaurosis.)

When the child was examined, he showed a trace of exophoria for near and distance. With the right eye fixating, there was a left hypertropia of 10 diopters for distance, 15 diopters for near. With the left eye fixating, the same amount of

right hypertropia was present both for distance and near. Vision was: R.E., 20/30; L.E., 20/100-i. The report from the Army surgeon stated that the right eye had been occluded for six months, and that vision in the left eye had improved from light perception to about 20/200. When examined under atropine, vision was: R.E., with a +2.25D. sph., 20/30. L.E., with a +2.50D. sph., 20/100. No glasses were prescribed. On the red-glass test, the red image was below with the red glass over either eye. There was a marked suppression of the left eye and constant occlusion was again instituted. He had peripheral fusion only, without amplitude, due to the deep-seated macular and paramacular suppression of the left eye.

Daily orthoptic exercises at the office for two weeks, with three weekly visits the following two weeks, were given. Training was directed to overcome the amblyopia and to improve the fusion. The wheel-like rotation was more marked in the right eye when treatment was begun, but improved markedly, with less marked improvement of this phenomenon in the left eye. After fusion developed with better fixation of the amblyopic eye, findings on the troposcope were: Subjective and objective setting, esophoria 4 diopters; *no hyperphoria*; fusional convergence 25 diopters; fusional divergence 9 diopters. With a 1-cm. target, he had a positive vertical divergence fusional amplitude of 30 diopters, recovery point at 22 diopters; and a negative vertical divergence fusional amplitude of 22 diopters, recovery point, 20 diopters. He had no cyclophoria on the horizontal lines. Incyclovergence measured 4 degrees as did the excyclovergence amplitude, which seemed subnormal in relation to the other fusional measurements.

His vision improved to 20/50-ii in the left eye. With the improved vision, his

fusion had improved, and consequently there was a lessening of the abnormal innervations for vertical divergence. Since he was only under treatment for one month, further progress cannot be reported.

GENERAL TREATMENT

The treatment should be general in that one should consider the person as a whole and all related factors, as well as the eyes, should be treated. If the general physical condition is below normal, immediate attention is given to this aspect. Attention is given to the environment, both at home and in school. There should be a minimum of psychologic disturbances and emotional stresses. General good health and plenty of outdoor exercise are prerequisites to a good prognosis for the eye condition. In cases in which the general nervous instability is marked, the orthoptic training should be guarded, as this may further strain an already overburdened nervous system.

Orthoptically, the treatment in these cases is essentially the establishment of good fusion and the correction of amblyopia, which is frequently present. Treatment is very similar to that of accommodative convergent squint. The patient can be taught voluntary control of the vertical deviation, just as the accommodative convergent squinter can control the lateral deviation. Dissociation training aids in teaching this control through mental effort.⁹ It is comparatively easy to build up good fusional amplitudes; in most cases they are normal or enlarged before any treatment is begun. However, if the orthoptic technician stops at this point, no progress is made because binocular instability is still present. A cure has been affected only after the dissociation exercises, both for near and distance, can be accomplished with comparative ease, and good binocular stability is established with

the disappearance of abnormal innervations. Some of the dissociation exercises are Dobson reading, bar reading, using a single, double, and triple bar successively, hand diploscope, reading the smallest legible print at 20 feet through a "hole in hand," Remy separator, using transparencies at first and then opaque objects, and finally reading.

In the beginning, voluntary fusion is taught without the aid of instrumentation, since it is easier to obtain without instruments. After the centers for willed fusional movements become stimulated by mental effort, the compulsion toward fusion becomes stronger with this reinforcement, and is cumulative with repeated effort. Gradually, the patient can accomplish this on a major amblyoscope, the Maddox wing, the diploscope, and the Remy separator. These are progressively more difficult in the order named. It is only when the patient finally succeeds in voluntarily maintaining fusion under these conditions that good results are obtained.

In cases having no fusion that are treated orthoptically for the establishment of fusion, the first sign of response to orthoptics is the appearance of a dissociated vertical divergence. As the suppression area is gradually reduced, and the double images gradually come closer to each other, and the paramacular area is reached, an *active antagonism to fusion* is demonstrated by an upward movement of the eye which is following a moving object as it is moved slowly toward the objective angle or the position where the foveas of the two eyes would fuse the images if fusion were present. This is subjectively noted by the patient when he observes that the image of the moving object goes under the image seen by the opposite eye, and when, as it approaches the opposite side of this image, he sees it come up to the same level with it. A careful observer will note the one eye moving

upwards and will then make a "searching" movement, gradually coming down and maintaining foveal fixation. This is done on the major amblyoscope, using 1-mm. to 5-mm. test objects in front of the "moving" eye and a larger dissimilar test object, preferably 2 cms. in size, in front of the opposite eye. As the suppression area is completely overcome and there is macular and foveal fusion, the dissociated vertical divergence movements disappear.

Surgery is contraindicated in cases of dissociated vertical divergence. If surgery is attempted in these cases, the results are usually as tragic as those of a surgically treated accommodative convergent squint. Both conditions are purely functional anomalies which have, possibly, the same or similar etiology.

Some ophthalmologists may feel, perhaps, that the question of diagnosis is outside the domain of the orthoptic tech-

nician. Since the diagnosis plays such an important part in the orthoptic therapeutic procedure of the vertical motor anomalies, this subject could not be discussed without mention of it. An orthoptic technician who cannot diagnose the type of vertical deviation present cannot treat it successfully.

I am deeply grateful to Dr. E. A. W. Sheppard, Louisa Wells Kramer, and the late Dr. William Thornwall Davis for their active interest and coöperation, which made research in this phase of orthoptics possible. It is my sincere hope that eventually others may interest themselves along these lines so that a broader knowledge will enable us to correct and cure the vertical motor anomalies with the same degree of success as the lateral motor disturbances.

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DISCUSSION OF MISS KRAMER'S PAPER

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Miss Kramer has given briefly the characteristics of the different types of the vertical anomalies. While the final responsibility of the diagnosis of the type or types (there may be more than one type or more than one muscle involved either in one or both eyes) rests with the ophthalmologist, the interested orthoptic technician will try to see in how many

not be advised by an observant, experienced orthoptic technician. After all, she sees the patient for a much longer time than does he. There are few physicians who will not be advised by an observing, well-trained, and experienced nurse—why then should they not be advised by a similar orthoptic technician?

One test and one examination is not sufficient to make a diagnosis. This is particularly applicable to those cases which have strong fusion.

CASE REPORTS

CASE 1

History. P. S., a man (fig. 1), aged 32 years, was seen on August 13, 1938. His chief complaint was that the left eye deviated up and out (fig. 1).

Examination: Uncorrected vision, O.D., was 20/20 correctable to 20/15 with a +0.50D. cyl. ax. 60°. Uncorrected vision, O.S., was 20/30 correctable to 20/15 with a +1.00D. cyl. ax. 90°. The cover test showed: Exot. 20, LH 40 diopters; Xt'. 18, LH' 18 diopters, Pcb, 8 cms. The rotations showed paralysis of the right inferior oblique with overaction of the agonist, the left superior rectus, and of the antagonist, the right superior oblique. The fusion was poor but when he did fuse he did so at orthophoria.

Treatment. On October 6, 1938, a recession of the left superior rectus was performed. Tests made on the next day with the Maddox rod in front of the right eye showed: RH 1-3, RH' trace to LH' 4; Maddox rod in front of the left eye: LH 6-8, RH' 8. The cover test showed: LH 8, X 16 LH' 0, Xt' 25. The red-glass reading was: RH 5, RH' 8. Six days later the red glass in front of the right eye gave: LH 2½, LH' 2½.



Fig. 1 (Sheppard). *Case 1.* This shows a paralysis of the right inferior oblique. The eye with the paralyzed muscle is the fixating eye. A recession of the left superior rectus was performed. The good result is due to a correct differential diagnosis and to good fusion (pre-operative photographs).

cases her diagnosis agrees with that of the ophthalmologist. If they are not in accord, it is definitely to the benefit of the patient that an agreement—not a compromise—be reached. And let not the ophthalmologist stand upon his dignity and

The Maddox rod in front of the right eye showed: LH $2\frac{1}{2}$, LH' 4. The cover test showed: LH 6, LH' 8. The synoptophore reading was: LH 2.

On October 22, 1938, orthoptic training was instituted. Fusion was found to be poor with complete suppression of the macular area of the left eye. On November 22, 1938, no symptoms were presented. The Maddox-wing test gave: LH 3; the Maddox rod: LH 5, LH' 3; the synoptophore: LH $2\frac{1}{2}$; the cover test: LH 10, LH' 10, X 6, X' 6. There was no diplopia with the red-glass or Worth four-dot tests.

Eight years later, on January 21, 1946, this patient had an occurrence of diplopia while he was under nervous strain when at sea. There were no symptoms when he was rested. Readings on the Maddox tangent scale were: LH, 4 degrees of arc to 8 degrees, troposcope with fusion charts: LH 3D. On May 23, 1946, orthoptic training was instituted. Directed to third-grade fusion and binocular stability, it first attempted to break down the macular suppression of the left eye. On July 19th, the Maddox-rod test showed, LH 3-5; LH' 3-6D. The patient's symptoms had disappeared, and there was third-grade fusion and binocular stability.

Summary. 1. A case of paralysis of the right inferior oblique, in which the eye with the paralysed muscle was the fixating eye, is presented.

2. The yoke muscle, the left superior rectus, was recessed.

3. Subjective postoperative measurements were misleading; had they been depended upon and had the suture been tightened, the outcome would have been less satisfactory. This emphasizes the importance of the differentiation and the evaluation of subjective and objective tests.

4. Although the patient had very

marked suppression, orthoptic training developed a poor, unstable fusion into a strong fusion with binocular stability.

5. In civilian life, he was able to overcome LH 40D. and Xt 20, preoperatively; whereas, under the physical and nervous strain of Navy sea duty he was unable to overcome LH 10D. and had diplopia.

CASE 2

History. L. S., a girl (fig. 2), aged $2\frac{1}{2}$ years, was seen on October 11, 1935, be-

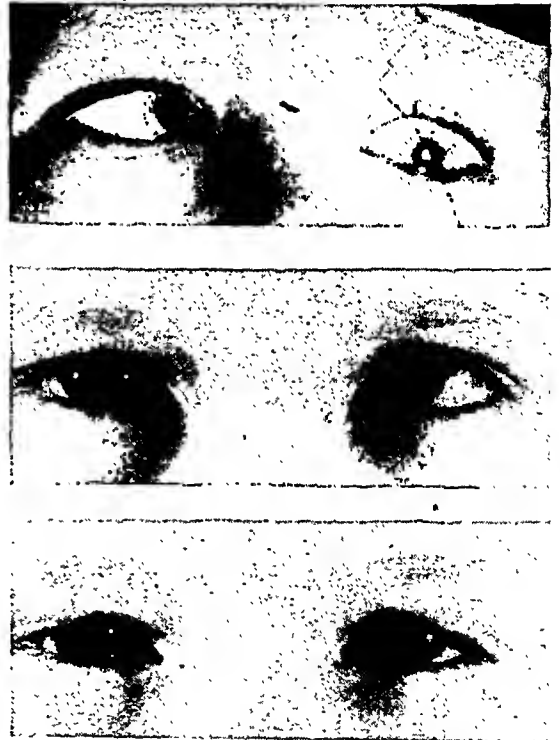


Fig. 2 (Sheppard). Case 2. This case presents convergent strabismus with right heterophoria. Eight operations were performed. Failure was due to an incomplete differential diagnosis and to abnormal retinal correspondence.

cause of a crossed right eye which had first been noticed when she was six months of age.

Examination showed Et 30D., Et' 35D. on the prism and cover test. The outward rotation of the right eye was restricted and there was marked up and in deviation of it; that is, "spasm of the right inferior oblique." Whether this overaction of the

right inferior oblique was secondary to paralysis of the right superior oblique or of the left superior rectus or both, or pseudoparetic, was never definitely determined. There was also a marked upward deviation of the left eye when adducted. No fusion was present.

Operations. 1. A Jameson recession of the right medial rectus was performed on April 28, 1936.

2. On January 19, 1937 a myectomy was done on the right inferior oblique.



Fig. 3 (Sheppard). *Case 3.* This woman, aged 52 years, had had a convergent strabismus since the age of seven years. A Jameson recession of the left medial rectus and a Worth advancement and resection of the left lateral rectus were performed. An old paralysis of the right inferior oblique was also present. The good result achieved in this case was due to a correct differential diagnosis and to good fusion (postoperative photograph).

3. A myectomy was done on the left inferior oblique on October 26, 1937.

4. A Reese resection was performed on the right lateral rectus on May 17, 1938.

5. On July 5, 1938, a Jameson recession was done on the left medial rectus.

6. On June 18, 1940, an advancement of the left inferior rectus was done.

7. An advancement of the left inferior rectus was done on July 30, 1940.

8. On the same date an advancement was performed on the right lateral rectus.

Examination on February 20, 1945, showed abnormal retinal correspondence both vertically and horizontally. The measurements were: Et 35, Et' 50, LH

30, LH' 25, with alternation and preference for fixation with the left eye.

Summary. 1. Surgery on the vertically acting muscles may well be deferred until one is absolutely sure of the diagnosis.

2. The differential diagnosis should be made, if possible, before any surgery is performed. The postoperative findings may not be characteristic, probably due to adhesions, scar tissue, or innervational factors.

3. In this case probably more than one type of deviation was present and both eyes were involved.

4. The unsatisfactory outcome was due to: (a) Not making a complete and correct diagnosis. (b) Operating before the diagnosis was made. (c) Abnormal retinal correspondence, both vertically and horizontally.

CASE 3

History. J. O'D., a woman (fig. 3), was first seen on June 16, 1923, when she was 30 years of age. She had an alternating convergent strabismus of each eye which had first been noted at the age of seven years. She had had no treatment other than glasses. Vision was 20/15 in each eye.

Examination. On April 8, 1937, cover-test findings were: Et 60, Et' 80D., with preference for fixation with the O.D.; on August 2, 1939, they were: Et 65, Et' 75; and on August 13, 1945, when the patient was 52 years of age, they were: Et 75D. Fusional amplitude on the synoptophore was from Et 70 to Et 95. There was normal retinal correspondence. A Jameson recession of the left medial rectus was done.

On April 20, 1945, the cover test showed: Et 40, Et' 40, LH 4-10. Rotations suggested an old right inferior oblique paralysis with overaction of the right superior oblique and the left superior rectus. Examination with the Mad-

dex tangent scale showed concomitant esotropia and concomitant LH.

Treatment. A Worth advancement and resection of the left lateral rectus was done on September 18, 1945. On September 25, the cover test showed: Xt 20, Xt' 25, Pcb remote. On October 6, 1945, the findings were: X 4, X' 4, LH 22, LH' 15, Pcb 15 cms. On October 15th, E 2, E' 2, LH 4, LH' 8, Pcb 10 cms. The following prescription was ordered: O.D., +100D. sph. = 20/15-i; O.S., +1.50D. sph. = 20/15-iii, Prism 3D., base down. Add +2.25D. sph. bifocals.

Orthoptic training was started on October 15, 1945. There was very marked suppression of the left eye, complete macular suppression. On March 4, 1946, the patient was comfortable without glasses for distance. The Worth-dot test showed fusion for near and distance; the cover-test findings were: E 2, E' 6, no hyperphoria; tests with the Maddox rod were: E 10, E' 15, LH 3-8, LH' 2-10; with the Maddox wing: E 13, LH 4; and with the troposcope: E 18, no LH, third-grade fusion.

On October 27, 1946, the troposcope showed: E 12, LH 2½; the Maddox wing: E 11, LH 4; the Maddox rod: E 6, E' 10-15, LH 2-7, LH' 4-7; the cover test: E 0, E' 6, +v.d. 3D., -v.d. 7D. The following correction was prescribed: O.D., +1.25D. sph. = 20/20+iii; O.S., +1.25D. sph. = 20/20-ii; add +2.00D. sph., bifocals. Glasses for near work only. The Worth-dot test showed fusion for near and distance, without correction.

Summary. 1. A high horizontal deviation may mask a low vertical deviation.

2. The patient had good fusion even after squinting for 45 years. The successful outcome was due to the strong fusion which was able to compensate for an LH of 0-7.

3. There was a marked psychologic improvement in the patient following the surgery. This undoubtedly had a favorable influence on the general nervous system which in turn favorably influenced the ocular nervous mechanism.

CONCLUSIONS

The vertical deviations present many more difficulties than the horizontal deviations because of:

1. The greater difficulties in diagnosis.
2. The lesser fusional amplitudes.
3. The greater difficulty in deciding upon what muscle to operate, what operation and how much.

For these and other reasons, orthoptic training in the vertical anomalies is essential. There is no material difference between orthoptic treatment of the vertical and the horizontal motor anomalies. The principles are the same; namely, differential diagnosis, correction of amblyopia and abnormal retinal correspondence, elimination of macular and foveal suppression, development and stimulation of fusion and fusional amplitudes and, lastly, good binocular stability for distance and near vision. The establishment of the last mentioned skill, good binocular stability, is the keynote for good results, orthoptically, in the vertical motor anomalies, more perhaps than in the horizontal motor anomalies.

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THE PRESERVATION OF CORNEAL TISSUE BY FREEZING AND DEHYDRATION*

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INTRODUCTION

One of the fundamental problems that confronted the Corneal Research Laboratory, when it was set up in conjunction with the Eye-Bank, was the study of methods to preserve the cornea. In the past, we were able to keep corneal tissue for a maximum period of three days. The corneas of adults were more easily preserved than those of infants or stillborn babies. There was also great individual variation in the ability of corneal tissue to withstand the autolytic processes that take place after removal. We attempted preservation of corneas in various hypertonic, isotonic, and hypotonic buffered physiologic solutions. We tried storing them as whole eyes or with the cornea detached. The most effective way to preserve them was found to be a moist chamber kept at 3° to 5°C. in which the eye was suspended above physiologic saline in such a manner that the cornea was never immersed in solution. The description of this chamber has been published elsewhere.¹

The publications by Weiss from the Department of Zoology of the University of Chicago came to our attention, and particularly the report on "The Transplantation of Frozen Dried Corneas in the Rat," by Weiss and Taylor.² If human cornea could be preserved in such a manner, it would be a great boon to the ophthalmic surgeon who could then have his graft material available at any time.

LITERATURE

The technique of fixation of tissues by drying while frozen, was first introduced by Altmann over 50 years ago, and this was described by Gersh.³ Further studies were made by Bensley and Gersh,⁴ Bensley and Hoerr,⁵ Hoerr,^{6,7} Simpson,⁸ and Taylor.⁹ These studies indicated that the histologic alterations in frozen tissues were due to formation of ice crystals which distorted the distribution of the protoplasm; that the more rapid the freezing process, the smaller the size of the ice crystals and the less the distortion. Further, that if the freezing had taken place at a very rapid rate and the ice removed by sublimation, the alteration in the histologic structure was minimal. Thus it was found, that the use of liquid nitrogen for freezing was the most satisfactory method; the tissues were immersed in practical isopentane that had previously been chilled with the liquid nitrogen. When the tissues were immersed directly in nitrogen, bubbles formed which acted as insulation and slowed up the process of freezing. Practical isopentane was used because it has a freezing point of about -200°C. Dehydration was performed by a diffusion vacuum pump which enabled the water vapor to sublime from the ice crystals and to be removed from the system by means of chemical dehydrators like phosphorous pentoxide. During the period of dehydration, the tissue was kept well below the freezing temperature of water.

The morphogenetic properties of frozen dried tissues were outlined in a paper presented by Weiss.¹⁰ Quick freezing and drying leave tissues in a more

* Under the auspices of the Ayer Foundation, in the Corneal Research Laboratory.

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normal condition than other preservative methods. These "devitalized" tissues remain relatively unmodified though their cells are dead. "This fact makes possible the study of the interrelationship between cells and matrix, by combining the 'devitalized' matrix of one tissue with living cells of another."

Weiss and Taylor¹¹ repaired injured peripheral nerves by grafts of frozen-dried nerve and proved they form excellent conductors for regenerating fibers. It was concluded through their experiments,¹² that by grafting frozen-dried nerves in cats and monkeys, full functional recovery may be obtained. A nerve gap of several centimeters could be bridged by the grafts of frozen-dried nerve, which had been stored for several months and rehydrated before use.

Frozen, dried, autogenous human skin grafting done by Webster¹³ proved successful in 80 percent of the cases. The best method, it was found, was to freeze the graft in CO₂ snow and butyl alcohol at -72°C. and then lyophilize in a vacuum which caused the graft to become shrunken, hard, and apparently dry.

Klinke¹⁴ demonstrated that mammalian cancers and embryonic normal tissue will survive freezing at very low temperatures. The tissues were dropped into liquid nitrogen or hydrogen and rapidly thawed in a few cc. of icy Tyrodes' solution, then cultured in nutritive media and tested with vital staining.

Experimentation using frozen cornea as donor tissue in corneal transplants was conducted by Smelser and Ozanics.¹⁵ Their studies showed that after eyes were frozen in isopentane, chilled with liquid nitrogen, and the cornea was used for grafting, the grafts became opaque in five days and remained so through 70 days (the period of observation). The grafts were easy to cut and were clear and normal in thickness until the cut edges came

in contact with physiologic saline solution, when they quickly became thick and edematous.

Transplantation of frozen-dried cornea in the rat was done by Weiss and Taylor² who reported satisfactory results. The grafted corneas in host eyes became incorporated by fusing circumferentially with the residual rim of the host cornea. They retained their laminated structure, and became resettled by the host cells, and remained transparent up to six weeks when the experiments terminated. These rat corneas had been placed in isopentane at -150°C.; evacuated at -40°C. for several days, then sealed in ampoules and stored. Before use, they were rehydrated in Ringer's Solution in vacuum, resuming normal consistency and appearance.

Detailed study was made of cultures of dried cornea by Filatov and Bazhenova^{16,17} and Bazhenova,¹⁸ and it was concluded that corneas dried in a desiccator until the weight was constant, lost 76.3 percent of the original weight. The cornea preserved its ability to grow in tissue culture as well as its viability. The growth of dried cornea started later than that of fresh cornea which had been preserved in the ice box. Further studies of dried corneas were pursued in which the method of tissue cultures was used to show the preservation of viability in a cornea desiccated to the limit and then immediately moistened with Ringer's Solution. The conclusions were:

1. In prolonged preservation of dried cornea, 39.7-percent water should be retained for best results.

2. A cornea dried to the point where it loses 46 percent of its original weight or 60.3 percent of its water content, may be preserved at 2°C. for as long as 10 days and retain its viability.

3. Cornea dried at a low temperature may yield an extensive growth in tissue culture. The growth occurs chiefly in

epithelial cells, and begins only after 3 to 4 days.

Experimental transplantation of dried and frozen cornea on rabbits done by Filatov and Bazhenova,¹⁹ demonstrated the resistance of the cornea to chemical and bacterial processes. Dryness of the cornea and low temperatures are the two factors in this resistance. Corneas that have lost almost all their water content, may form a transparent implant if they are moistened soon after dried. Excellent results were obtained with corneas which had lost 15 to 20 percent of their original weight with subsequent conservation at 2 to 4°C. Freezing exerts a more deleterious effect on the cornea. Preserved at 3°C., the corneal transparency is retained, but the integrity deteriorates with further lowering of temperature. The isolated cornea gives better results than the cornea from a preserved eyeball.

Experimental preservation of cadaver eyes on ice in various preservatives was conducted by Petroysan.²⁰ Data from this experiment showed that eyes kept at 2° to 4°C. undergo changes which increase in intensity with the period of conservation. In the cornea, the epithelium became irregular, opaque, and edematous; opacity became pronounced on the seventh day when erosions appeared. The cornea remained transparent during the first eight days, but became opaque in 20 days. It remained transparent longest in a 1:2000 brilliant-green solution with the cornea upward. These changes in the epithelium have no effect on the fate of the corneal transplant; therefore, it was assumed that the corneal change in the early stages of conservation are not irremediable and do not prevent the cornea from returning to normal.

Skorodinska²¹ concluded that at low temperature the regeneration of corneal epithelium of eyes is possible.

COMMENT

The investigations concerning the preservation of the cornea conducted by the Russians were primarily done at ice-box temperatures and in a chemical desiccator. They also tried temperatures below 0°C., but reported failures. The freezing experiments of Smelser and Ozanics did not dehydrate the cornea, and were unsuccessful. It had been demonstrated, as noted above, that living cells could be frozen at very low temperatures and dehydrated and still preserve their viability. The question arose as to whether the cornea could retain its transparency and viability after such treatment.

Our own experiences with prolonged preservation of corneas at ice-box temperatures were not encouraging, therefore we hoped to be able to duplicate the work of Weiss and Taylor. Whether the graft is accepted by the host as a living tissue, or is replaced by the cells of the host, is still a subject of considerable controversy. If the donor cornea has to retain its viability, which is our belief, then the graft must be a living graft. Certainly if the host cornea will accept a living graft from another individual, the cornea is the only tissue in which this is possible.

APPARATUS

A freezing-dehydrating apparatus such as was described by Taylor²² was constructed. The manifold was made of glass, otherwise the apparatus was essentially the same (fig. 1). We found that the glass manifold made possible a more complete vacuum. The principle of the apparatus was to provide a constant stream of cold vapor from CO₂ ice, which was kept in the reservoir thermos jar (10 liters). The cold vapor poured down a copper tube into the smaller thermos jar (4 liters), and maintained a temperature in the latter vessel of -40°C. The tem-



Fig. 1 (Katzin). A frame of metal pipe supports the horizontal reservoir for CO_2 ice. Mounted above it is the McLeod gauge; in front of it is a glass manifold with the outlets as noted in the text. Between the manifold and the gauge is a separatory funnel containing calcium chloride. In the manifold there is a tray containing phosphorous pentoxide. Below the manifold there are three Flotsdorf-Mudd vials, the center one containing three frozen cornea discs. Behind these vials is the Hy-Vac pump. The cold-chamber thermos jar has been lowered to the floor and its supporting shelf swung to one side. An isopentane thermometer can be seen in front of the vials and behind the vials is the metal vane which acts as a thermoregulator for the cold chamber.

perature was regulated by a valve consisting of a metal vane controlled by a bi-metallic helical thermoregulator. The glass manifold provided with seven connecting tubes was mounted above the smaller thermos jar (the cold chamber). The outlets on the manifold were arranged as

follows: One was connected to a high vacuum, oil-diffusion pump; one to a McLeod mercury vacuum gauge; one was a 2-inch diameter, ground-glass stopper; and one was connected to a separatory funnel packed with calcium chloride and equipped with a valve to release the

vacuum; the remaining three extended into the cold chamber through its cover. The 2-inch ground-glass stopper was removable in order to place the tray containing the phosphorous pentoxide inside the manifold.

The frozen corneas were placed in rubber stoppered glass vials that attached to the three tubes which projected into the cold chamber. These vials are the type supplied for the Flotsdorf-Mudd lyophile apparatus.²³

Liquid nitrogen was transported in all-metal thermos bottles (of the type commercially available from the Stanley Manufacturing Company) and transferred when necessary by pyrex glass syphon tubes.

METHOD

Fresh donor eyes were obtained daily from rabbits which had been killed for the performance of the Aschheim-Zondek test. These eyes were enucleated and donor grafts removed by means of a 5-mm. automatic Green's trephine. It was found that three donor discs could be obtained from each eye. These discs were dropped into a test tube containing practical isopentane (Eastman Kodak Company). The isopentane was previously chilled by immersing the test tube in liquid nitrogen. A temperature of about -180°C . was obtained in this manner. The corneal discs froze immediately and were transferred to dry lyophile vials which were packed in a freezing mixture of CO_2 snow and acetone. As soon as the three frozen corneas had been transferred, the vial was placed in the cold chamber. Three such vials were evacuated at a time. Some of the grafts were frozen directly in liquid nitrogen instead of being immersed in isopentane, as will be noted below.

As soon as the vials were fixed to the

manifold connecting tubes, the system was evacuated and the vacuum maintained for a period varying between 4 and 11 days. Every two days the supply of CO_2 ice was replenished and the phosphorous pentoxide was removed and replaced. After the period of dehydration by evacuation, the vials were sealed in vacuo and placed in the ice box. The grafts were rehydrated in normal saline just prior to their use in cornea grafting.

The grafting operation was performed in routine fashion with a single preplaced, clover-shaped corneal stitch, and the rabbits were observed postoperatively for periods up to seven months.

In 11 instances, the grafts were dropped into chilled isopentane and in eight instances directly into liquid nitrogen prior to transferral to the freezing dehydrating apparatus. Eight grafts were dehydrated for four days, seven for seven days, three for nine days, and one for 11 days.

Fourteen of the donor grafts were transferred directly into the freezing liquid after having been freshly cut with a Green trephine. The remaining five were first washed with a 1:30-dilution of rabbit's serum.

In no instance was the cornea preserved for more than 48 hours after dehydration. When ready for use, the cornea grafts were removed from the sealed vial and dropped into normal saline solution one hour before the estimated time of transplantation. The rehydrated cornea was then used as the donor graft. The recipient eyes were normal.

RESULTS

It was found by trial that in one hour's time the frozen-dried graft dropped into saline would rehydrate and clear to a maximum degree. Longer periods would render the grafts too edematous. Of the

grafts that were used for transplantation, seven were translucent, six were clear in the center but opaque at the edges, two were opaque in the center but translucent at the edges, and four were completely opaque. When the graft was rehydrated, it was difficult in some instances to deter-

day; and one on the 21st day. Two rabbits died on the third day from extraneous causes.

CONCLUSIONS

Attempts to preserve rabbit corneas for transplantation by rapid freezing at the temperature of liquid nitrogen and de-

TABLE 1
RESULTS OBTAINED IN USE OF FROZEN-DRIED CORNEAL GRAFTS

No.	Days Dehydrated	Condition of Graft When Rehydrated	Cooling Solution	Postoperative Day Graft Became Opaque
3	7	Translucent in center	Isopentane	9th
4	9	Opaque	Isopentane	7th
13	7	Translucent	Liquid Nitrogen	9th
17	4	Translucent	Liquid Nitrogen	4th
18	4	Translucent	Liquid Nitrogen	4th
20	4	Translucent in center	Liquid Nitrogen	Died 3rd day
21 O.S.	4	Opaque	Liquid Nitrogen	4th
21 O.D.	7	Opaque in center	Liquid Nitrogen	4th
22	4	Translucent in center	Liquid Nitrogen	Died 3rd day
23	4	Opaque	Liquid Nitrogen	13th
25 O.S.	4	Translucent	Isopentane	14th
26	4	Translucent	Isopentane	4th
28	7	Translucent in center	Isopentane	4th
30	7	Opaque in center	Isopentane	4th
33	4	Opaque	Isopentane	4th
387 O.S.	9	Translucent	Isopentane	7th
387 O.D.	7	Translucent in center	Isopentane	7th
390 O.D.	11	Translucent	Isopentane	14th
390 O.S.	9	Translucent in center	Isopentane	21st

mine which was the epithelium and which was the endothelium, and it was found that the epithelium came off in flakes.

The postoperative results disclosed that all the grafts eventually became opaque. Seven were opaque on the 3rd to 4th day, three on the 6th to 7th day, three on the 9th to 10th day, four on the 13th to 14th

hydrating in vacuo at -40°C . have failed to produce a transparent graft. Cornea grafts took and healed in place, but did not remain clear. Various modifications in technique were employed as noted above, without any significant effect on the result, since no graft remained clear.

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EXPERIMENTAL STUDIES IN RETROBULBAR NEURITIS*

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The etiologic relationship of nutrition and intoxication to retrobulbar neuritis has long been a problem in ophthalmology and more recent studies have not particularly clarified the situation. This is not surprising since pellagra itself presents a number of etiologic problems, which, in part, have led some authors to classify their cases as simple pellagra, pellagra associated with alcoholism, and pellagra complicating other diseases. The occurrence of retrobulbar neuritis in the nutritional pellagra of past generations was relatively frequent, yet at the present time a change in this situation is recognized by Fine and Lachman,¹ for they state, "One wonders why the visual symptoms which were apparently so common in the pellagra of the last generation are so infrequent today." Calhoun² reviewed the literature in 1918 and reported 10 new cases of retrobulbar neuritis. Since that time, numerous reports of ocular complications in nutritional pellagra are found in the Russian literature, but only the five cases reported by Wagner and Weir³ in this country appear to be of primary nutritional etiology, and these did not occur in pellagra patients. It is noteworthy that at the present time among the numerous cases of nutritional pellagra seen in the southern part of the United States, few cases of retrobulbar neuritis are reported. In the North, most cases of pellagra are of the alcoholic type, and in these, and in the nonpellagra alcoholic, most cases of retrobulbar neuritis associated with nutritional disturb-

ances occur. The more recent American literature deals almost exclusively with the alcoholic variety of pellagra—Levine,⁴ Johnson,⁵ Fine and Lachman,¹ Carroll.⁶ In some of these patients, tobacco may have played a part, but, according to Carroll,⁷ "There has accumulated a considerable number of reports all tending to indicate . . . that so-called alcoholic polyneuritis is a manifestation of a deficiency disease and is not due to a direct neurotoxic effect of the alcohol."

A disturbing circumstance in this hypothesis is that many cases of retrobulbar neuritis of the tobacco and alcohol group show no manifestation of pellagra, and only a therapeutic response to thiamine hydrochloride indicates a relationship to vitamin B. Furthermore, retrobulbar neuritis occurs with great frequency in deficiency states in some parts of the world, and, although these patients are benefited by vitamin-B therapy, other factors of a toxic nature are recognized as contributing to the production of the syndrome. Moore,⁸ in 1937, reported the frequent occurrence of retrobulbar neuritis and optic atrophy in the numerous pellagrose natives of Nigeria. He quotes other observers from the Gold Coast, Jamaica, Solomon Islands, Barbados, and Malaya, who have observed a similar syndrome. Clark⁹ investigated the chemical nature of the diet of the Nigerians and determined that it was high in cyanide-bearing foodstuffs, and that the incidence of pellagra and optic neuritis was proportional to the cyanide content of the diet. Clark and Moore expressed the opinion that there is much clinically to support the presence of a toxic element plus a deficiency.

In 1943, McDermott, Webster, *et al.*,¹⁰

* From the Department of Ophthalmology, College of Medicine, State University of Iowa. Read at the 82nd annual meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.

published the first report of the production of a nutritional degeneration of the optic nerves in experimental animals. They observed advanced optic-nerve degeneration in rats that had been on a B-complex deficient diet for $5\frac{1}{2}$ to 12 weeks. With this information at hand and the possibility of a relationship between cyanide and the occurrence of retrobulbar neuritis, new methods of approaching the problem became evident. A series of experiments was planned in the hope that, by one or various methods, changes in the optic nerves of experimental animals could be studied. Because of the reports of McDermott and Webster, rats were used, and since Sprague-Dawley animals were available in our laboratory, these were used rather than the hybrid strain used in their experiments.

EXPERIMENTAL PROCEDURE

The basic synthetic diet for the rat experiments consisted of:

Cerelose	680 gms.
Casein (vitamin free)	180 gms.
Crisco	80 gms.
Salt mixture (Hubbell No. 351) ¹¹	40 gms.
Cod-liver oil	20 gms.

To this was added in crystalline* form for vitamin-B-complex supplement the following:

Thiamine hydrochloride	10.00 mg.
Riboflavin	20.00 mg.
Piridoxine hydrochloride	0.75 mg.
Calcium pantothenate	5.00 mg.
Nicotinic acid	50.00 mg.
Para-aminobenzoic acid	100.00 mg.
Inositol	100.00 mg.
Choline chloride	1.00 gm.

For exposure to cyanide the animals were placed in an air-tight cage through which air laden with hydrocyanic-acid gas in concentration of 3 gamma percent \pm 1 was drawn.¹² This dosage of hydrocyanic-acid gas in air is one half the concentra-

tion that kills rats in from two to six hours. Appropriate diets were fed during the continuous exposure to cyanide.

Histologic material was removed from the experimental animals after killing them by breaking the necks. The eyes were fixed in Nissl's fixative and stained with cresyl violet for study of the ganglion cells of the retina. Pieces of the optic nerves and sciatic nerves were fixed in paraffin to be stained by Marchi's method for demonstration of early dissolution of the myelin sheaths of the nerves. Similar pieces of the nerves were fixed in Zenker's fluid for Held's myelin sheath stain,¹³ which demonstrates permanent destruction of the myelin sheath following atrophy of the axis cylinder.

EXPERIMENTS

1.—*Vitamin-B-complex deficient rats.* Groups of animals of equal weight, but varying in the different groups from 50 to 100 gm. were fed on the basic diet without vitamin-B supplement. In two weeks, evidence of deficiency consisted of poor appetite, failure to gain weight, and changes in the fur, but approximately four weeks had elapsed before arched back and stiff hind legs were apparent. There was slight loss in weight, and the animals looked poorly. These signs persisted and the animals died in from 4 to 10 weeks if allowed to go to termination. At various intervals, animals were killed and tissue taken for histologic study.

2.—*Thiamine deficiency.* Animals in groups of equal weight but varying between groups from 50 to 100 gm. were fed the basic diet plus all the B-complex supplement except thiamine hydrochloride. These animals followed the same course as the B-complex deficient animals.

2a.—*Thiamine deficiency plus exposure to hydrogen-cyanide gas.* This group of animals was placed on a thiamine-

* Crystalline vitamins were furnished by Merck & Company.

deficient diet and after a 2½-week depletion period was placed in the cyanide chamber. The deficient diet was continued and the course was similar to that of the animals in Group 2.

3.—*Riboflavin deficiency.* Animals of 40 to 50 gm. were placed on the basic diet plus the crystalline B supplement except for riboflavin. These animals did not increase in weight but remained alive for 4 to 6 months. Eyes, optic nerves, and sciatic nerves were taken when the deficiency was established.

4.—*Low protein and inadequate thiamine hydrochloride.* In this experiment the basic diet was modified by reducing the protein content from 18 percent to 9 percent. The thiamine supplement also was reduced to one half the usual amount. The experiment was continued for 21 weeks during which time, although the animals failed to gain weight, the skeleton continued to grow and, at the time of termination of the experiment, the osseous system was approximately that of a normal rat of the same age. Retina, optic nerves, and sciatic nerves were taken for histologic study.

4a.—*Low protein and inadequate thiamine hydrochloride plus exposure to hydrogen-cyanide gas.* A group of animals on the above diet was kept in the closed chamber and continuously exposed to hydrogen-cyanide gas. The duration of the experiment was 17 weeks.

5.—*Commercial diet plus hydrogen-cyanide gas.* Animals of approximately 200 gm. weight were exposed to hydrogen-cyanide gas in the gas chamber for a period of three months. Diet during this time was the commercial stock diet for small animals. These animals were allowed food at pleasure, and the amount eaten was recorded. There was no gain in weight, but the animals appeared healthy throughout the experiment.

5a.—*Limited commercial diet.* A group

of animals of approximately 200 gm. weight was fed on commercial diet for a period of three months. The food consumed was equal in amount to that consumed by the above Group 5. These animals also did not gain in weight, but they were much more active than the group exposed to cyanide.

6.—*Basic diet plus riboflavin and thiamine hydrochloride with hydrogen-cyanide exposure.* A group of 200-gm. rats was exposed to hydrogen cyanide and fed the basic diet to which was added four times the usual amount of riboflavin and thiamine hydrochloride. A record of the amount of food consumed was made. The experiment was continued for 12 weeks. The animals did not gain in weight but appeared healthy throughout the experiment.

6a.—*Basic diet plus riboflavin and thiamine hydrochloride.* These animals were of the same weight as those in Group 6 and were fed the same amount of diet that the cyanide group consumed. Except for greater activity, there was slight difference in the appearance of the two groups.

RESULTS

1.—*Vitamin-B complex deficient.* Although animals from this group had developed signs of extensive peripheral neuritis and were in a moribund state at the termination of the experiment, the optic nerves and retinas showed no evidence of involvement of the third visual neuron.

Sciatic nerve sections prepared by Marchi's method showed rather extensive acute degeneration of the myelin but evidence of permanent change was not observed in the Held preparations.

2.—*Thiamine deficiency.* Table 1 shows the histologic changes observed in tissues removed from these animals. In most instances, the degeneration of the myelin in

the sciatic nerve was advanced, as demonstrated by Marchi's technique, but was normal in the Held stain. Optic-nerve changes were minimal and consisted of only a few very fine droplets of black in most sections. No changes were observed in sections stained with the Held stain. Retinal ganglion cells appeared swollen but apparently this was not an irreversible

130 to 176 days on a deficient diet, the optic nerves were normal by Marchi and Held methods. Rather extensive disintegration of the myelin in the sciatic nerves was observed with the Marchi but the Held stains were normal. The retinal ganglion cells showed no significant changes.

4.—Low protein and inadequate thia-

TABLE 1
THIAMINE DEFICIENT, NO CYANIDE

Animal	Duration	Optic Nerves		Sciatic Nerves		Ganglion Cells of Retina
		Marchi	Held	Marchi	Held	
M-6-2	5 weeks	1%	Normal	5%	Normal	Swelling
M-8-1	5 weeks	Trace	Normal	2%	Normal	Swelling
M-8-7	5½ weeks	Trace	Normal	30%	Normal	Swelling
M-6-3	6 weeks	2%	Normal	40%	Normal	Swelling
M-7-1	6 weeks	Trace	Normal	25%	Normal	—
M-7-2	7 weeks	Trace	Normal	40%	Normal	—
M-7-3	7 weeks	1%	Normal	45%	Normal	Normal

TABLE 2
THIAMINE DEFICIENT, HYDROGEN CYANIDE 3 GAMMA PERCENT ± 1 IN AIR

Animal	Duration	Cyanide Duration	Optic Nerves		Sciatic Nerves		Ganglion Cells of Retina
			Marchi	Held	Marchi	Held	
M-8-2	5 weeks	19 days	Normal	Normal	5%	Normal	Swelling
M-8-3	5 weeks	19 days	Normal	Normal	Trace	Normal	Swelling
M-8-8	5½ weeks	21 days	Normal	Normal	15%	Normal	Normal
M-8-9	5½ weeks	21 days	Normal	Normal	20%	Normal	Swelling

change since animals that had recovered from severe deficiency showed normal optic nerves and ganglion cells.

2a.—Thiamine deficiency and cyanide. These animals, in spite of the continuous exposure to an atmosphere of cyanide during the final three weeks of the experiment showed less change than did the previous group (table 2). Although the retinal ganglion cells were swollen, the optic nerves were normal with both Marchi and Held stains. Only in Marchi preparations of the sciatic nerve were changes observed, and these were not as great as those noted in Table 2.

3.—Riboflavin deficiency. After from

mine hydrochloride. As shown in Table 3, sciatic-nerve myelin degeneration was noted in Marchi's preparations in varying amounts, and it occurred as early as 2½ weeks. Held stain of the myelin sheaths failed to show any evidence of permanent degeneration, and after a recovery period, the Marchi stains were normal. The optic nerves showed only a small amount of myelin degeneration by the Marchi method and no changes were seen in the Held stain. The retina was normal.

4a.—Low protein, inadequate thiamine hydrochloride and cyanide. In this series of animals, Table 4, the degenerative phenomena in both the optic and sciatic

nerves were considerably greater than in the control, Group 4. Myelin disintegration was more extensive with the Marchi stain, but here, too, evidence of irreversible degeneration was not obtained by Held stain. After a recovery period of

nerve (table 5). The retinal ganglion cells were normal and the Held stains were normal.

5a.—*Limited commercial diet.* After three months on the same diet as Group 5, the optic nerves showed somewhat

TABLE 3
PROTEIN AND THIAMINE DEFICIENT, NO CYANIDE

Animal	Duration	Optic Nerves		Sciatic Nerves		Ganglion Cells of Retina
		Marchi	Held	Marchi	Held	
PT-7-C	17 days	Trace	Normal	Trace	Normal	—
PT-1-C	15 weeks	Trace	Normal	15%	Normal	Swelling
PT-2-C	17 weeks	Trace	Normal	20%	Normal	Swelling
PT-4-C	21 weeks	Trace	Normal	1%	Normal	Swelling
PT-5-C	21 weeks	Trace	Normal	20%	Normal	Swelling

TABLE 4
PROTEIN AND THIAMINE DEFICIENT, HYDROGEN CYANIDE 3 GAMMA PERCENT ± 1 IN AIR

Animal	Duration	Cyanide Duration	Optic Nerves		Sciatic Nerves		Ganglion Cells of Retina
			Marchi	Held	Marchi	Held	
PT-7	17 days	17 days	Normal	Normal	15%	Normal	Normal.
PT-8	14 days	14 days	Trace	Normal	5%	Normal	Normal
PT-3	21 days	21 days	1%	Normal	5%	Normal	Swelling
PT-6	40 days	40 days	1%	Normal	65%	Normal	Normal
PT-1	12 weeks	12 weeks	Trace	Normal	15%	Normal	Normal
PT-2	14 weeks	14 weeks	Trace	Normal	45%	Normal	Normal
PT-4	16 weeks	16 weeks	Trace	Normal	1%	Normal	Normal
PT-5	17 weeks	17 weeks	1%	Normal	15%	Normal	Normal

TABLE 5
STOCK DIET, HYDROGEN CYANIDE 3 GAMMA PERCENT ± 1 IN AIR

Animal	Duration	Cyanide Duration	Optic Nerves		Sciatic Nerves		Ganglion Cells of Retina
			Marchi	Held	Marchi	Held	
CC-1	3 months	3 months	Trace	Normal	15%	Normal	Swelling
CC-2	3 months	3 months	Trace	Normal	3%	Normal	Swelling
CC-3	3 months	3 months	Trace	Normal	1%	Normal	Swelling

several weeks, all stains of the nerves were normal. The retinal ganglion cells were within normal limits.

5.—*Commercial diet plus cyanide.* After three months' exposure to hydrogen-cyanide gas, the optic nerves showed a trace of degeneration with the Marchi stain, and slight change in the sciatic

greater degeneration of the myelin with the Marchi stain, but the sciatic nerve was less involved than in the previous group (table 6). The retinal ganglion cells were normal. Held stains of the optic and sciatic nerves were normal.

6.—*Basic diet plus riboflavin and thiamine hydrochloride with hydrogen-cya-*

nide exposure. After 83 days, this experiment was terminated because of mechanical difficulty. There was extensive degeneration of the sciatic nerve with Marchi stain but the optic nerves and retinal ganglion cells remained without signifi-

8). Held stain was normal. Three animals were placed on commercial diet after three months on the synthetic diet. These showed improvement in the condition of the sciatic nerves, but myelin sheath degeneration was now observed in the optic

TABLE 6
STOCK DIET, NO CYANIDE

Animal	Duration	Optic Nerves		Sciatic Nerves		Ganglion Cells of Retina
		Marchi	Held	Marchi	Held	
CC-1-C	3 months	Trace	Normal	Trace	Normal	Swelling
CC-2-C	3 months	Trace	Normal	Trace	Normal	Swelling
CC-3-C	3 months	Trace	Normal	Normal	Normal	Swelling

TABLE 7
VITAMIN-B DEFICIENT EXCEPT EXCESS RIBOFLAVIN AND THIAMINE,
HYDROGEN CYANIDE 3 GAMMA PERCENT \pm 1 IN AIR

Animal	Duration	Cyanide Duration	Optic Nerves		Sciatic Nerves		Ganglion Cells of Retina
			Marchi	Held	Marchi	Held	
TR-1	12 weeks	12 weeks	Trace	Normal	35%	Normal	Swelling
TR-2	12 weeks	12 weeks	Normal	Normal	70%	Normal	Swelling
TR-3	12 weeks	12 weeks	Normal	Normal	5%	Normal	Normal
TR-4	12 weeks	12 weeks	Trace	Normal	30%	Normal	Swelling
TR-5	12 weeks	12 weeks	Normal	Normal	25%	Normal	Swelling

TABLE 8
VITAMIN-B DEFICIENT EXCEPT EXCESS RIBOFLAVIN AND THIAMINE, NO CYANIDE

Animal	Duration	Optic Nerves		Sciatic Nerves		Ganglion Cells of Retina
		Marchi	Held	Marchi	Held	
TR-1-C	3 months	Normal	Normal	40%	Normal	Normal
TR-2-C	3 months	Normal	Normal	45%	Normal	Normal
TR-3-C*	3 months	1%	Normal	Trace	Normal	Swelling
TR-4-C*	3 months	Trace	Normal	Trace	Normal	Swelling
TR-5-C*	3 months	Trace	Normal	Trace	Normal	Swelling

* After three months on diet these animals were fed on commercial diet for one month.

cant change (table 7). In every event the Held stain showed no evidence of degeneration.

6a.—Basic diet plus excess of riboflavin and thiamine hydrochloride. These animals showed degeneration in the sciatic nerve with the Marchi stain, but the optic nerve and retina were normal (table

8). Held stain was normal. Three animals were placed on commercial diet after three months on the synthetic diet. These showed improvement in the condition of the sciatic nerves, but myelin sheath degeneration was now observed in the optic

DISCUSSION

In none of the experiments was significant degeneration in the optic nerves observed. This is particularly interesting in that the groups on vitamin-B-complex

deficiency and those on thiamine deficiency were reduced to extreme degrees of malnutrition and were at the point of death at the time of the removal of tissue for examination. Furthermore, these experiments fail to confirm the work of McDermott, Webster, *et al.*, who had previously reported the occurrence of degeneration in the optic nerves of rats fed on a B-complex deficient diet. One regrets that these observers did not report the condition of the ganglion cells of the retina, for this information would have contributed greatly to the value of their experiments.

In the event that there is irreversible degeneration in the optic nerves, the ganglion cells undergo chromatolysis and eventually disappear. When the changes in the nerve are reversible there is usually clearly defined evidence of the injury to the nerve by the reaction in the ganglion cell. This consists of swelling of the nucleus, peripheral clumping of the Nissl substance, and vacuolation of the nucleus which is pushed to the side of the cell. Cells so affected usually return to normal when the disease process in the nerve has healed, although a few ganglion cells may go on to complete dissolution. Unfortunately, in our studies, conclusive evidence of injury to the ganglion cells was not obtained. In all instances these cells were closely studied by the Nissl technique, and in many instances swelling of the nuclei and fragmentation of the cells were observed. However, this observation at times was made on ganglion cells from normal retinas. It could be assumed that in those cases in which there was injury to the nerve as demonstrated by the Marchi stain that there was some chromatolysis of the ganglion cells, but this assumption is dangerous in that chromatolysis should be a substantiation of the Marchi method. Had our experiments shown decisive degeneration in the optic

nerves, chromatolysis in the ganglion cells would be necessary to prove the validity of the optic-nerve damage.

Swank¹⁴ has observed that starvation produces myelin-sheath degeneration, but that only when there is concurrent degeneration in the axis cylinder (and, *per se*, chromatolysis in the ganglion cells) can a diagnosis of the thiamine deficiency be made. In some of our animals, starvation conditions were approached (tables 4 and 5). In the group of animals fed on restricted quantity of commercial diet, slight degeneration was observed in the myelin sheaths of both the optic and sciatic nerves, yet no attempt had been made to deplete the diet of any of the essential elements. The animals received only a sufficient amount of food to maintain their weight. The rats shown in Table 5 also received only sufficient food to maintain their weight, but there was a deficiency of all the members of vitamin-B complex except thiamine hydrochloride and riboflavin. These were given in four times the required amount, and in this experiment the degenerative changes in the sciatic nerve myelin sheaths were extensive, but the optic nerves were normal. The amount of degeneration seems comparable to that which occurs with thiamine deficiency alone. Since an absence of thiamine in the diet is followed by a loss of appetite, it becomes difficult to evaluate the relative effect of starvation and the deprivation of vitamin B₁ on the degenerative phenomena that we have observed.

The cyanide experiments were devised in order to attempt to duplicate the dietary circumstances of the Nigerian natives. In large doses, cyanide produces nerve degeneration and areas of necrosis in the brain,¹⁵ and in pigeons¹⁶ its effect has been compared with that of thiamine deficiency. Experiments had previously not been made with low sublethal con-

centrations of cyanide acting continuously over a long period of time, but we succeeded in maintaining a concentration of 3 gamma percent (± 1 gamma) in air for an indefinite period of time. Table 4 shows the results of hydrogen cyanide in this concentration on the optic and sciatic nerves of rats after three months' exposure. Some slight degeneration of the myelin of the optic nerves was present, but more definite change was noted in the sciatic nerves. This amount of change was not great, and the amount was not consistent from one animal to another. It was observed that exposure to this concentration of cyanide caused loss of appetite and failure of the animals to gain in weight. When thiamine is removed from the diet and cyanide administered in the air, the amount of degeneration is little different from the control animals on thiamine deficiency alone. This experiment was of only $5\frac{1}{2}$ weeks' duration, so conclusive evidence of comparative effects of cyanide were not available. To allow the animals to survive a longer period of exposure, the diet was changed to include one half the required amount of thiamine, but in order to intensify the effects of the cyanide, if possible, the protein content of the diet was reduced to nine percent instead of the usual 18 percent. These animals survived four months and showed variable amounts of change in the optic and sciatic nerves. Apparently there is slightly more degeneration in the cyanide-exposed animals than in the "control

group" with dietary deficiencies alone.

In order to determine the effects of thiamine and riboflavin as factors in preventing degeneration, another group of animals was used in which vitamin-B-complex factors other than riboflavin and thiamine were deficient. The thiamine and riboflavin content was increased to four times normal but, in spite of this, extensive degeneration occurred in the myelin of the sciatic nerves of the animals exposed to cyanide. These animals did not eat well and failed to gain weight during the 83-day experimental period, but there were no external evidences of vitamin deficiency. The experiment was planned for a longer period of time but was terminated because of mechanical difficulties with the cyanide chamber.

A method for producing uniform and extensive degeneration in the optic nerves and retinal ganglion cells of rats has as yet not been found. Part of our difficulty may be due to short duration of the experiments, and present work is directed toward correcting this. Long-time exposures of the animals to a relative deficiency rather than a complete lack of some or of all members of the B complex may yield better results. Further experiments with limitations of protein, especially the sulfur-bearing ones, may limit the detoxifying powers of the animals, and thereby increase the effect of the cyanide. The age of the rats has not been a factor in degenerative phenomena thus far, but further study of this must be made.

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NONPERFORATING OCULAR INJURIES IN SOLDIERS*

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Approximately 4,000 eyes enucleated in army hospitals between Pearl Harbor and V-J Day have been received at the Army Institute of Pathology. This material is being subjected to pathologic study in an effort to obtain additional information regarding the reaction of the ocular tissues to trauma. The great majority of injuries were perforating wounds with or without retention of foreign bodies. These will be considered in a subsequent paper. This report deals only with those injuries which did not include penetration of the eyeball. The number of soldiers incurring ocular wounds of this description was 104; 47 during combat or training; 57 before entering the service.

The interval between injury incurred during combat or training and enucleation varied from less than one day to 2½ years. These cases have been studied by subdividing them on the basis of time elapsing between injury and enucleation—less than one day, one day to two weeks, two weeks to three months, and three months to 2½ years.

EYES ILLUSTRATING IMMEDIATE CHANGES

Four eyes enucleated on the day of injury illustrate the changes which were immediate.

CASE 1. A.I.P. ACCESSION 80348

The patient was unconscious and was bleeding from the nose and right eye when brought to the hospital immediately following an airplane crash. He was found to have a penetrating wound through the right orbit, which had caused fracture of the orbit, laceration of the cerebrum, and cerebral hemorrhage.

Pathologic observations. Hemorrhagic and serous exudate with a high polymorphonuclear leukocyte content was present in the orbital tissues attached posteriorly to the globe. There was a little hemorrhage into the anterior chamber; red blood cells clung to the posterior surface of the iris and to the ciliary processes. On one side there was hemorrhagic detachment of the choroid. Degenerative changes were beginning to take place in the lens.

CASE 2. A.I.P. ACCESSION 88565

A 50-caliber cartridge exploded in the patient's hand, injuring the eye.

*From the Army Institute of Pathology, Washington, D.C. Read before the American Academy of Ophthalmology and Otolaryngology, October 17, 1946.

Pathologic observations. Massive intra-ocular hemorrhage had occurred in the shallow anterior chamber, in Schlemm's canal, beneath the detached ciliary body, choroid, and retina, and in the vitreous chamber. A metallic foreign body was found in the adherent orbital tissues.

CASE 3. A.I.P. ACCESSION 91571

The patient was struck by an automobile, receiving a compound comminuted

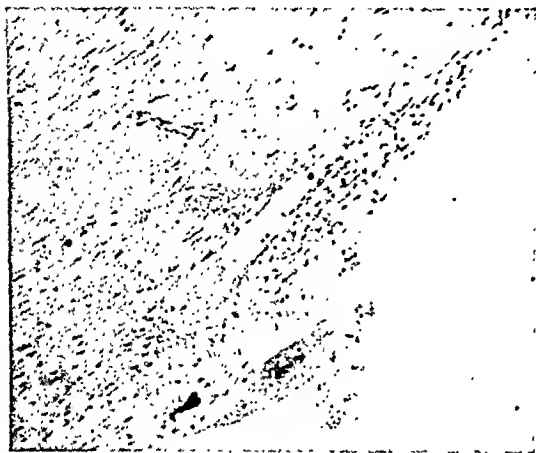


Fig. 1 (Rones and Wilder). Rupture of the meshwork of the anterior chamber angle. Hemorrhage in the canal of Schlemm. $\times 240$. A.I.P. Negative No. 90121.

fracture of the right side of the skull, and an orbital injury. The eyeball was dislocated external to the lids, and the optic nerve appeared to be ruptured.

Pathologic observations. On one side hemorrhage engorged Schlemm's canal (fig. 1). Rupture of the filtration angle may have resulted from the concussion, but the coloboma of the iris seemed to be an artefact. Hemorrhage had occurred in the ciliary body, and there was hemorrhagic detachment of the choroid. Hemorrhage, with a rather high polymorphonuclear leukocyte content, was present in the anterior and vitreous chambers. The ciliary processes were edematous. The nerve head was covered by hemorrhage.

Beginning degenerative changes were apparent in the cortical lens fibers.

CASE 4. A.I.P. ACCESSION 123954

The patient was in a vehicle wreck, and the right eye was gouged out.

Pathologic observations. Recent hemorrhage was observed in the angle of the anterior chamber, in the posterior chamber, and around the ciliary processes. There were small subretinal hemorrhages near the disc. The optic nerve was severed traumatically.

The dominant finding in these four eyes enucleated the day on which the injury was incurred was fresh hemorrhage. Blood was found in all the ocular interspaces and throughout all intraocular structures. The mechanical effects of the blow and the amount of blood were factors which determined the variations in the ocular architecture. It is noteworthy that in two of these cases incipient cataract was identified less than 24 hours following injury.

EYES REMOVED WITHIN TWO WEEKS

Eight eyes removed within two weeks of injury illustrate the changes which took place relatively soon after trauma.

CASE 5. A.I.P. ACCESSION 104621

The patient, who was in a truck accident, had severe proptosis with apparent evulsion of the optic nerve.

Pathologic observations. The optic nerve appeared to have been pulled out. There was dense thickening of the sclera. Massive hemorrhage was both intraocular and orbital, with hemorrhagic detachment of the ciliary body, choroid, and retina. The lens was cataractous. There was purulent panophthalmitis and orbital cellulitis (fig. 2).

CASE 6. A.I.P. ACCESSION 101534

The patient was struck in the eye with

a baseball, which caused hemorrhage into the anterior chamber. Two days later a massive intraocular hemorrhage produced secondary glaucoma. Paracentesis was performed five days after injury.

Pathologic observations. Polymorphonuclear leukocytes infiltrated the corneal stroma. The iris was hemorrhagic, necrotic, and infiltrated by purulent exudate, and on one side was torn away from the ciliary body. Hemorrhage from the filtration angle filled the anterior cham-

ber, and was evident beneath the retina at the ora serrata, in the anterior vitreous, and in the cupped optic disc.

CASE 8. A.I.P. ACCESSION 102835

Injury to the eye from an exploding cartridge caused hemorrhage into the an-



Fig. 3 (Rones and Wilder). Rupture of the filtration angle. Hemorrhage in the anterior and posterior chambers. $\times 70$. A.I.P. Negative No. 90132.

terior chamber with resulting secondary glaucoma.

Pathologic observations. The filtration angle was ruptured. Hemorrhage was present in the anterior and posterior chambers (fig. 3).

CASE 9. A.I.P. ACCESSION 116154

Shell fragments had entered the patient's left cheek and cut the right optic nerve.

Pathologic observations. There was a ring abscess of the cornea. Purulent exudate occupied the anterior and posterior chambers and the filtration angle, and also infiltrated the ciliary epithelium. There were broken posterior synechiae. The ciliary processes were partially hyalinized. On one side the retina was torn and extensive subchoroidal and subretinal hemorrhages were present. The optic nerve appeared edematous and degenerated, and purulent exudate infiltrated the trabeculae and nerve sheaths.

CASE 10. A.I.P. ACCESSION 131220

A mine explosion in battle caused a

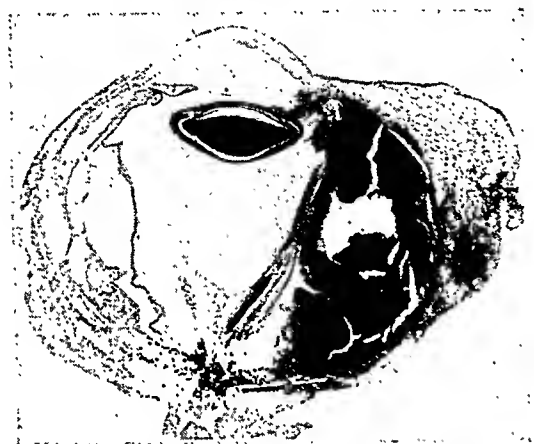


Fig. 2. (Rones and Wilder). Evulsion of the optic nerve. Rupture of the filtration angle. Massive subchoroidal hemorrhage. A.I.P. Negative No. 90178.

ber, and was evident beneath the retina at the ora serrata, in the anterior vitreous, and in the cupped optic disc.

CASE 7. A.I.P. ACCESSION 112891

The patient was struck in the eye by a hard object; hemorrhage and secondary glaucoma resulted. Posterior sclerotomy and iridectomy were performed, but the iridocyclitis and secondary glaucoma persisted.

Pathologic observations. Organized hemorrhage was present in the anterior chamber, occluding the pupillary space, and in the vitreous. Chronic iridocyclitis was evident, and iris tissue was incar-

penetrating wound of the left cheek and contusion of the left eye.

Pathologic observations. There was massive intraocular hemorrhage. The cataractous lens was dislocated into the posterior vitreous; the retina was detached; and gliosis had occurred. The pigment epithelium of the ciliary processes was proliferated, with wide-spread scattering of pigment cells. Organization of the vitreous hemorrhage had begun.

CASE 11. A.I.P. ACCESSION 115207

The patient was struck by an automobile and incurred a head injury which resulted in death.

Pathologic observations. The retina was edematous and folded in the macular region. Small hemorrhages were present in the inner nuclear layer of the retina. Although there was slight edema of the optic nerve head, physiologic cupping was still present.

CASE 12. A.I.P. ACCESSION 136147

The patient was struck by a mortar shell which caused a severe contusion of the left eye with iridodialysis, traumatic cataract, and intraocular hemorrhage.

Pathologic observations. There was massive hemorrhage into the anterior chamber. On one side the iris was torn away from the ciliary body, and beneath this the lens capsule had been ruptured at the equator. The lens was cataractous. Extensive posterior synechiae were present. The epithelium of the iris and ciliary body was proliferated; the ciliary body hemorrhagic and infiltrated with chronic inflammatory cells. There was a massive vitreous hemorrhage. The lamina cribrosa was markedly depressed.

In the eight eyes described, enough time had elapsed after the injury for beginning organization of the intraocular hemorrhages to have become apparent. Inflammation, present in five eyes, was

purulent in three. Secondary glaucoma had resulted from massive intraocular hemorrhage in four eyes.

TWO WEEKS TO THREE MONTHS

Fifteen eyes enucleated between two weeks and three months following injury were also examined, and in them the organization of hemorrhage was more advanced, the incidence of chronic inflammation had increased, and early atrophic changes were seen.

CASE 13. A.I.P. ACCESSION 116524

The patient was hit in the eye by a fragment from an exploding booby trap. Ciliary injection and hypotony appeared. The eye was enucleated one month after injury.

Pathologic observations. The pupillary margin of the iris on the temporal side was ruptured, and posterior synechiae and a pupillary membrane had developed. There was phagocytized hemosiderin in the anterior chamber and in the residuum of hemorrhage in the vitreous. There was hemorrhagic and serous separation of the retina with edema of the macula.

CASE 14. A.I.P. ACCESSION 118213

Fragments from an exploding booby trap struck the eye, causing iridodialysis. Recurrent intraocular hemorrhages produced secondary glaucoma. Paracentesis

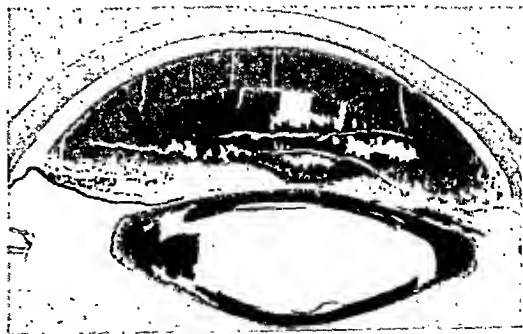


Fig. 4 (Rones and Wilder). Massive hemorrhage in the anterior chamber. $\times 12$. A.I.P. Negative No. 90124.

was performed. The eye was enucleated six weeks after injury.

Pathologic observations. Traumatic iridodialysis was present, together with hemorrhages and atrophy of the iris. There were anterior and posterior synechiae, and a massive hemorrhage in the anterior chamber (fig. 4). The lens showed an anterior cortical cataract. The macula was edematous, and secondary

terior synechiae, atrophy of the iris, disorganization of the iris pigment epithelium, and scar tissue on the anterior

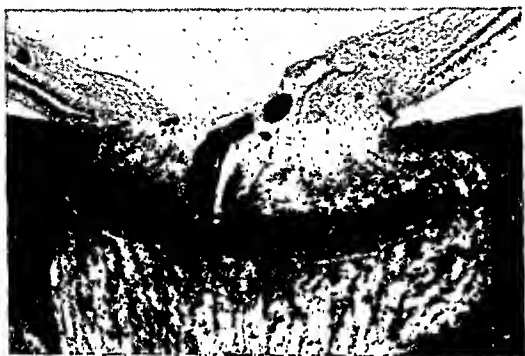


Fig. 5 (Rones and Wilder). Early depression of the lamina cribrosa. $\times 40$. A.I.P. Negative No. 90133.

glaucoma was manifested by the depressed lamina cribrosa (fig. 5).

CASE 15. A.I.P. ACCESSION 81675

Flying fragments of the skull of another soldier struck the patient's right eye, causing severe contusion with intraocular hemorrhage and traumatic cataract. Active panophthalmitis developed two weeks after injury and did not respond to treatment. The eye was enucleated 34 days after injury.

Pathologic observations. Blood pigment was present in the interlamellar spaces of the cornea. Hemorrhagic and serous exudate containing pigment-laden phagocytes filled the anterior chamber. On the nasal side, the iris was almost completely replaced by organizing hemorrhagic and inflammatory exudate which formed an adhesion between the cornea and the lens. On the other side were peripheral an-

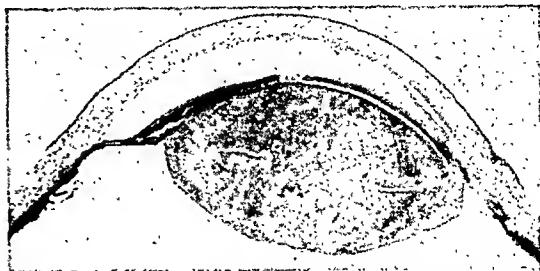


Fig. 6 (Rones and Wilder). Organizing hemorrhage in the anterior chamber, resulting from traumatic iridodialysis. Extensive anterior and posterior synechiae. Atrophy of the iris and ciliary body. Cataract. $\times 8$. A.I.P. Negative No. 90149.

surface of the iris. The lens had undergone degenerative change (fig. 6). The ciliary body was atrophic, and on the nasal side its processes were pulled forward by organizing hemorrhage in the anterior vitreous. Chronic inflammatory cells infiltrated the uveal tract. Lymphocytic periphlebitis was evident in the retina with edema and folding in the macular region. Secondary glaucoma was evidenced by the depressed nerve head and lamina cribrosa.

CASE 16. A.I.P. ACCESSION 112157

The eye was struck by a stream of water from a fire hose, with resulting intraocular hemorrhage, dislocated lens, and lacerated iris. Paracentesis was performed. The eye was enucleated 25 days after injury.

Pathologic observations. Organizing hemorrhage was present in the anterior chamber. The cornea was blood stained; the iris lacerated; the retina partially detached, and there was hemorrhagic detachment of the choroid. The lens was cataractous. Subacute keratitis and iridocyclitis were observed.

CASE 17. A.I.P. ACCESSION 122874

Contusion caused severe hemorrhage into the anterior chamber, and secondary glaucoma. The eye was blind and painful. An attempt was made to extract a traumatic cataract. The eye was enucleated six weeks after injury.

Pathologic observations. The cornea and scar of the operative wound at the limbus were infiltrated with chronic inflammatory cells. Organizing hemorrhage filled the anterior chamber. Remnants of the lens capsule and cortex were visible. A massive abscess and hemorrhage filled the vitreous. A large subchoroidal hemorrhage was present, and the retina was detached.

CASE 18. A.I.P. ACCESSION 86403

The eye was injured by a gun-powder explosion, and enucleated seven weeks later.

Pathologic observations. Schlemm's canal was filled with serous exudate and surrounded by dense lymphocytic infiltration. Chronic inflammatory cells and polymorphonuclear leukocytes clung to the posterior corneal surface, to the anterior surface of the iris, and to the zonular fibers. The iris was edematous and infiltrated by plasma cells and lymphocytes, as were also the ciliary body, the inner layers of the retina, and the nerve head. The ciliary body and the peripheral choroid were stretched by the traction of plastic inflammatory exudate in the anterior vitreous.

CASE 19. A.I.P. ACCESSION 118751

A shell fragment penetrated the orbit. The eyeball was not perforated, but the globe became shrunken and painful. The eye was enucleated 18 days after injury.

Pathologic observations. The lens was cataractous and dislocated into the pos-

terior vitreous. The iris was ruptured. There was organizing massive intraocular hemorrhage. The retina was detached and disorganized.

CASE 20. A.I.P. ACCESSION 105515

Injury to the eye resulted from a powder explosion. The eye was enucleated two months later.

Pathologic observations. Epidermalization of corneal epithelium had taken place over the scarred and vascularized substantia. Pigment granules were seen in the spaces of Fontana. The iris was edematous. The ciliary body was atrophic and sparsely infiltrated by chronic inflammatory cells. Its processes were partially hyalinized. There was microcystic degeneration of the outer plexiform layer of the retina, as well as serous exudates in the outer plexiform and nerve-fiber layers. Degenerative changes were present in the anterior cortical fibers of the lens.

CASE 21. A.I.P. ACCESSION 101532

A blow caused hemorrhage and secondary glaucoma in an eye which had been defective since birth. Calcareous deposits were seen in the cornea; the lens was opaque, and annular posterior synechiae were present. The eye was enucleated two months after injury.

Pathologic observations. The cornea showed pannus degenerativus with calcareous deposits and vascularization. Inflammatory tissue and organizing hemorrhage formed a membrane which covered the anterior surface of the iris, occluded the pupillary space, and incarcerated the degenerated remains of the lens. The ciliary processes adhered to the posterior surface of the iris. Posteriorly there was ossification of the choroid. Lymphocytes and plasma cells infiltrated the uveal tract. The retina was detached, and the subret-

inal space was filled with serous exudate containing hemorrhage, cholesterol slits, and phagocytic wandering cells. The retina, which had undergone gliosis and microcystic degeneration, contained serous exudate and laminated drusen, and obliterative changes had taken place in some of the retinal vessels.

CASE 22. A.I.P. ACCESSION 105522

The patient was struck in the eye by a piece of wood, which caused laceration of the iris and retinal detachment. The eye was enucleated two months after the injury.

Pathologic observations. On one side, the iris was torn away from the ciliary body and was hemorrhagic and partially necrotic. Hemorrhage filled the coloboma and extended into the posterior and vitreous chambers. On the opposite side, strands of organizing hemorrhage and pigment-laden cells were present in the filtration angle. Degenerative changes had occurred in the cortical lens fibers. Hemorrhage had caused detachment of the retina, and there was massive subretinal hemorrhage in the macular region.

CASE 23. A.I.P. ACCESSION 146081

The patient was struck by a baseball on the left side of the forehead. At first no injury to the left eye was apparent, but two days later a large hemorrhage occurred in the anterior chamber. An intractable secondary glaucoma followed, and repeated paracentesis of the anterior chamber did not relieve the pain. The eye was enucleated three weeks after injury.

Pathologic observations. The massive hemorrhage in the anterior chamber contained considerable scattered pigment from the epithelial layer of the iris. On one side, the iris and filtration angle were ruptured, and the iris was necrotic. The pigment epithelial layer of the retina showed considerable hyperplasia.

CASE 24. A.I.P. ACCESSION 131247

A shell fragment penetrated the lid and the floor of the orbit, causing iridodialysis and massive vitreous hemorrhage. The eye was enucleated 15 days after injury.

Pathologic observations. A traumatic coloboma with organizing hemorrhage occupied the defect. Extensive rupture and detachment of the choroid and retina were present. There were large hemorrhages in the anterior and vitreous chambers, and in the subretinal and subchoroidal spaces.

CASE 25. A.I.P. ACCESSION 140195

Fragments from an exploding booby trap struck the eye and caused severe intraocular hemorrhage, rapid swelling of the lens and secondary glaucoma. One month after injury the lens was removed. The eye was enucleated seven weeks after injury.

Pathologic observations. There was a large operative scar in the cornea to which there were extensive adhesions of the iris, and of lens fragments and capsule. Inflammatory scar tissue occluded the pupillary space. A large organizing hemorrhage was present in the anterior vitreous, and there was extensive serous detachment of the retina. Subacute iridocyclitis was complicated by eosinophilia.

CASE 26. A.I.P. ACCESSION 132983

Injury to the eye in battle caused severe vitreous hemorrhage and complete detachment of the retina. Mild iridocyclitis developed in the other eye, and enucleation was performed two months after injury because sympathetic ophthalmia was feared.

Pathologic observations. There was a large hemorrhage in the posterior vitreous chamber, with organization over the disc involving the retina. The retina was partially detached and there was hemorrhage in the subretinal space. Hemor-

rhage in the anterior chamber and peripheral anterior synechiae were observed, but there was no evidence of sympathetic ophthalmia.

CASE 27. A.I.P. ACCESSION 136110

A bullet entered through the right zygomatic region and made its exit through the left. There was marked displacement of the left infraorbital plate, with downward displacement of the globe. The eye was enucleated ten weeks after injury.

Pathologic observations. The optic nerve was partially evulsed and the choroid had prolapsed into the arachnoid space. Organizing hemorrhage extended from the nerve head and adjacent choroid into the vitreous chamber.

INTERVAL OF THREE TO THIRTY MONTHS

In 20 eyes enucleated between three months and 2½ years following injury, the incidence of inflammation and secondary glaucoma was further increased, and there was one instance of equatorial staphyloma. Inflammatory pupillary and cyclitic membranes were seen and, for the first time in this series, calcium deposits in the lens and phthisis bulbi were observed.

CASE 28. A.I.P. ACCESSION 122877

The eye was hit by a fragment of exploding shell. Enucleation was performed three months after injury.

Pathologic observations. The remains of a hemorrhage were still present in the anterior chamber, and an organized hemorrhagic membrane covered the anterior surface of the iris. There were peripheral anterior synechiae. The ciliary processes were elongated and their epithelium proliferated. The retina was detached and had undergone gliosis.

CASE 29. A.I.P. ACCESSION 101964

The eye was struck by a stone. Cataract and secondary glaucoma resulted and enucleation was performed three months after injury.

Pathologic observations. There was chronic iridocyclitis with serous exudate in the anterior, posterior, and vitreous chambers. Iris bombé was present. The lens showed early degenerative changes. The lamina cribrosa was depressed from glaucoma.

CASE 30. A.I.P. ACCESSION 104773

After the eye was struck by a squash ball, repeated hemorrhages in the anterior chamber resulted in secondary glaucoma. Pain persisted despite repeated paracentesis. The eye was enucleated three months after injury.

Pathologic observations. The anterior chamber was almost completely obliterated by organizing hemorrhage which occluded the pupil. There were anterior and posterior synechiae and anterior displacement of the cataractous lens (fig. 7).



Fig. 7 (Rones and Wilder). Organizing hemorrhage in the anterior chamber occluding the pupil. Anterior displacement and degeneration of the lens. Hemorrhage in the vitreous chamber. $\times 12$. A.I.P. Negative No. 90125.

Hemorrhage in the vitreous chamber and in the subretinal space, chronic iridocyclitis, and secondary glaucoma were present.

CASE 31. A.I.P. ACCESSION 107046

A baseball had struck the eye causing

dislocation of the lens and secondary glaucoma. The eye was enucleated 3½ months after injury.

Pathologic observations. There were chronic iridocyclitis and peripheral anterior synechiae. A small hemorrhage in

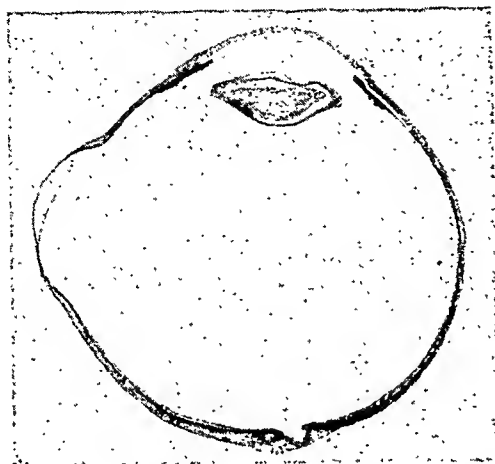


Fig. 8 (Rones and Wilder). Chronic glaucoma with equatorial staphyloma. $\times 2$. A.I.P. Negative No. 97213.

the vitreous was beginning to organize. An equatorial staphyloma was present with serous detachment and cystic degeneration of the retina at this point. Secondary glaucoma was evidenced by marked excavation of the optic disc (fig. 8).

CASE 32. A.I.P. ACCESSION 105295

A blow from a fist caused severe intra-ocular hemorrhage and secondary glaucoma. Tension was not lowered by posterior sclerotomy. The eye was enucleated four months after injury.

Pathologic observations. There were peripheral anterior synechiae, atrophy of the iris and ectropion uveae. The pigment epithelium was somewhat scattered and a few of its cells clung to the anterior surface of the iris. Anterior to the sclerotomy scar the ciliary body was atrophic, and posterior to it the retina was detached. The lamina cribrosa was depressed and there were atrophic changes in the

optic nerve. The lens was dislocated laterally.

CASE 33. A.I.P. ACCESSION 87772

After a blow from a fist severe intra-ocular hemorrhage occurred and endophthalmitis developed. The eye was enucleated 4½ months after injury.

Pathologic observations. On one side, the iris was torn away from the ciliary body and almost completely replaced by scar tissue which extended across the anterior surface of the lens, incarcerated the iris pigment epithelium and sphincter muscle, and covered the anterior surface of the iris on the other side. The ciliary processes showed some hyalinization. Organizing hemorrhage extended across the anterior vitreous behind the lens, which was cataractous. There was microcystic degeneration of the retina, and the choroid was infiltrated by lymphocytes and plasma cells. The lamina cribrosa was somewhat depressed.

CASE 34. A.I.P. ACCESSION 88843

The blow of a fist caused hemorrhage in the eye. A traumatic cataract was removed two months after injury. Three months later phthisis bulbi had developed and the eye was enucleated.

Pathologic observations. The perforating, operative wound at the limbus had healed. The iris was absent and ciliary processes and scar tissue occluded the filtration angle. There was a large hemorrhage in the anterior chamber and there were serous and hemorrhagic exudates in the subretinal space and vitreous. The retina was detached and showed marked lymphocytic periphlebitis. Organizing hemorrhagic and inflammatory exudate was beginning to form a cyclitic membrane. The nerve head was pulled forward and the lamina cribrosa was not depressed.

CASE 35. A.I.P. ACCESSION 116864

Injury to the eye from an exploding land mine caused iridodialysis, vitreous hemorrhage, endophthalmitis, and secondary glaucoma. The eye was enucleated 5½ months after injury.

Pathologic observations. There were traumatic iridodialysis and vascularization of the anterior surface of the iris. The ciliary processes were adherent to the meshwork in the angle of the anterior chamber at the site of the iridodialysis. There was slight chronic iridocyclitis. Organizing hemorrhage was present in the vitreous. The optic nerve was atrophic and the lamina cribrosa depressed.

CASE 36. A.I.P. ACCESSION 87429

In an automobile accident the patient sustained a skull fracture and an arteriovenous aneurysm of the right internal carotid with resultant proptosis of the right eye. The eye was enucleated six months after injury.

Pathologic observations. A purulent corneal ulcer was secondary to paralysis of the trigeminal nerve and exposure. Serous exudate was present in the angle of the anterior chamber. The vascularity of the iris was greatly increased. Lymphocytes and plasma cells infiltrated the iris and the anterior ciliary body; the ciliary processes were edematous and their vessels engorged. On one side, there was peripheral detachment of the retina with subretinal serous exudate. Multiple hemorrhages had occurred in the nerve fiber and outer plexiform layers of the retina. The optic disc was cupped and filled with serous exudate, and the lamina cribrosa was depressed.

CASE 37. A.I.P. ACCESSION 115860

The eye was struck by a soccer ball, with resulting chronic iridocyclitis and phthisis bulbi. It was enucleated seven months after injury.

Pathologic observations. The iris had been ruptured, and its stroma replaced by organized hemorrhage which also filled the pupillary space. There was blood staining of the cornea. The lens was cataractous. Organizing hemorrhage filled the vitreous, and a plastic hemorrhagic and inflammatory cyclitic membrane had formed. Subretinal hemorrhage had caused retinal detachment. There were chronic endophthalmitis and beginning phthisis bulbi.

CASE 38. A.I.P. ACCESSION 105658

Injury to the eye by water under pressure caused repeated hemorrhages in the anterior chamber and secondary glaucoma. Paracentesis was performed, but endophthalmitis developed. The eye was enucleated nine months after injury.

Pathologic observations. An organized hemorrhage was present in the anterior chamber. The lens was cataractous. There was mild chronic iridocyclitis, with some disorganization of the iris pigment, and several posterior synechiae. The lamina cribrosa was depressed.

CASE 39. A.I.P. ACCESSION 113277

The patient was hit in the eye by a shoe and secondary glaucoma developed. A trephination and lens extraction were performed several months after the injury but the glaucoma persisted. The eye was enucleated 18 months after injury.

Pathologic observations. Fragments of proliferated lens capsule and cortex were incarcerated in the operative scar. There was mild chronic iridocyclitis with peripheral anterior synechiae. The pigment layer of the iris showed some destruction, with pigment-laden, wandering cells in the anterior and posterior chambers. The lamina cribrosa was depressed.

CASE 40. A.I.P. ACCESSION 113298

During training on an obstacle course,

the patient fell and struck his eye. Acute glaucoma necessitated iridectomy. The lens then became swollen and was removed 17 months after injury. Iridocyclitis developed. The eye was enucleated 20 months after injury.

Pathologic observations. The remaining iris tissue was adherent to the capsular and cortical fragments of the lens. Chronic iridocyclitis and a large intraocular hemorrhage were evident, and the lamina cribrosa was depressed.

CASE 41. A.I.P. ACCESSION 117649

The patient was struck in the eye while in commando training. The eye was enucleated two years after injury.

Pathologic observations. A traumatic, calcified cataract was present. There was chronic iridocyclitis, with wide anterior and posterior synechiae. The lens was displaced anteriorly and the anterior chamber was obliterated. There was an inflammatory cyclitic membrane and complete detachment of the retina, with massive subretinal serous exudate (fig. 9). Colloid excrescences were observed on Bruch's membrane.

CASE 42. A.I.P. ACCESSION 117900

The eye was struck by a baseball; cataract occurred, followed by recurrent inflammation and phthisis bulbi. The Kahn reaction was positive but became negative under treatment. The eye was enucleated two years after injury.

Pathologic observations. Anterior synechiae almost completely obliterated the anterior chamber. A dense mass of scar tissue occluded the pupil and formed an adhesion between the cornea, the anteriorly displaced lens, and the iris. There was an anterior capsular cataract, and the cortical lens fibers had degenerated. A granulomatous inflammatory process, in which foci of epithelioid cells with oc-

casional giant cells were sparsely surrounded by lymphocytes and plasma cells, involved the vascular layer of the ciliary body and the ciliary epithelium, forming adhesions to the lens. The retina was partially detached, was cystically degenerated, and contained serous exudates.

CASE 43. A.I.P. ACCESSION 110660

The blow of a fist caused cataract, chronic iridocyclitis, and phthisis bulbi.

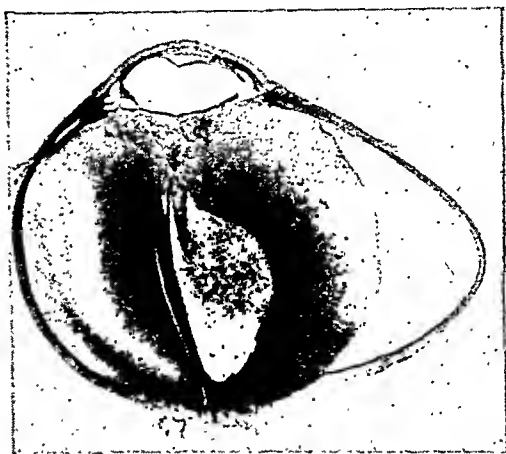


Fig. 9 (Rones and Wilder). Inflammatory cyclitic membrane with detachment of the retina and subretinal serous exudate. $\times 2$. A.I.P. Negative No. 97212.

The eye was enucleated $2\frac{1}{2}$ years after injury.

Pathologic observations. A traumatic cataract contained calcium deposits. Chronic endophthalmitis had produced posterior synechiae and inflammatory pupillary and cyclitic membranes. The retina was detached and had undergone cystic degeneration; serous exudates were in and beneath it. Colloid excrescences were seen on Bruch's membrane. Phthisis bulbi had developed.

CASE 44. A.I.P. ACCESSION 122205

A baseball struck the eye, causing rupture of the iris, repeated intraocular hemorrhages, disorganization of the globe, and secondary glaucoma. The eye

was enucleated 5½ months after injury.

Pathologic observations. A coloboma of the iris was present, also anterior and posterior synechiae and a pupillary membrane. The ciliary body was atrophic and the lens cataractous. Secondary glaucoma was manifested by marked cupping of the optic disc.

CASE 45. A.I.P. ACCESSION 137517

A bomb explosion injured the right orbit, causing detachment of the retina and iridocyclitis. The eye was enucleated 3½ months after injury.

CASE 46. A.I.P. ACCESSION 130076

The eye was struck by an inner tube, with resulting iridocyclitis and traumatic cataract. It was enucleated nine months after injury.

Pathologic observations. A mass of scar tissue bound the atrophic iris to the cataractous lens, completely occluding the pupillary space. There was chronic iridocyclitis. The retina was edematous in the macular region.

CASE 47. A.I.P. ACCESSION 127493

The eye was struck by a slingshot.

TABLE 1
PATHOLOGIC CHANGES DUE TO RECENT NONPERFORATING INJURIES

	Same Day	2 Weeks	2 Weeks to 3 Months	3 Months to 2½ Years
Hemorrhage				
Intraocular	4	6	2	
Organizing		1	9	10
Cataract	2	2	6	13
Detachment				
Choroid	2	1	2	1
Ciliary Body and Choroid	1	1		
Retina	1	2	7	10
Rupture of Filtration Angle	1	1	1	
Evulsion of Optic Nerve		2	1	
Purulent Ophthalmitis		3		
Secondary Glaucoma		4	3	11
Iridodialysis		2	5	3
Nonpurulent Endophthalmitis		2	8	17
Retinal Hemorrhages		1		1
Rupture of Pupillary Margin			2	
Edema of Macula			2	2
Blood Staining of Cornea			1	1
Dislocated Lens				
Posterior			1	
Anterior				2
Lateral				1
Cystic Degeneration of Retina				2
Phthisis Bulbi				3

Pathologic observations. The iris was edematous, and there were wide posterior synechiae. The hemorrhage in the anterior vitreous had been partially phagocytosed. Chronic chorioretinitis and extensive cystic degeneration of the outer plexiform layer of the retina were present.

Cataract developed, followed by attacks of chronic iridocyclitis and then by secondary glaucoma. The tension was not relieved by an iris inclusion operation, and the eye was enucleated 18 months after injury.

Pathologic observations. The operative scar at the limbus was cystoid and there

was a traumatic cataract. Extensive serous detachment of the retina was associated with chronic iridocyclitis and secondary glaucoma, with marked excavation of the disc.

DISCUSSION

Table 1 is a recapitulation of the types of lesions resulting from recent nonperforating injuries to the eye. Intraocular hemorrhage is most frequent, and is variously situated depending upon the vessels damaged. Rupture of an iris vessel can cause a massive hemorrhage in the anterior chamber. In the posterior segment of the globe the site and extent of hemorrhage depend upon whether a ciliary, retinal, or choroidal vessel is ruptured.



Fig. 10 (Rones and Wilder). Traumatic iridodialysis, recent. $\times 10$. A.I.P. Negative No. 90131.

Concussion cataract was observed in 23 cases in this series, two of them in eyes enucleated the day they were injured. Such cataracts may be due to rupture of the lens capsule resulting from compression of the eye, which allows access of the aqueous to the lens fibers. Dislocations of the lens also occur, anteriorly, posteriorly, or laterally, depending upon the direction of the blow and the manner in which the suspensory ligaments are torn.

A blow upon the anterior surface of the globe pushes the aqueous backward and to the side. Since the aqueous cannot be compressed, the force is reflected backward against the iris and the lens, causing them to recede or tear where they are

weakest; namely, at the iris root and through the zonular ligaments (figs. 10, 11, 12). Such an iridodialysis commonly involves only a portion of the circumfer-



Fig. 11 (Rones and Wilder). Traumatic iridodialysis, recent, with hemorrhage into the anterior and posterior chambers. $\times 35$. A.I.P. Negative No. 90154.

ence of the iris root, although the circumferential tear may be complete.

The force of a blow from a blunt instrument on the anterior segment of the globe may also be dispersed so as to cause rupture of the pupillary margin of the iris, including the sphincter, or rupture of the filtration angle. The force of such a blow may be reflected posteriorly to produce detachments of the retina, the choroid, and the ciliary body. In addition,

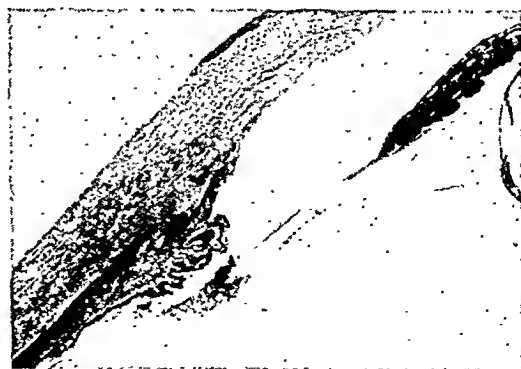


Fig. 12 (Rones and Wilder). Traumatic iridodialysis with beginning closure of the coloboma by organizing hemorrhage. $\times 30$. A.I.P. Negative No. 90127.

evulsion of the optic nerve has been encountered in three cases of this series.

Secondary glaucoma was a frequent sequel to contusion injuries, and resulted from massive hemorrhage, dislocation of the lens, or synechiae following recurrent nonpurulent endophthalmitis. The optic nerve may early show the effects of this increased pressure; in one case the lamina cribrosa was depressed six weeks after

was precipitated by recurrent iridocyclitis or hemorrhages. These eyes were blind in all cases, and prolonged and recurrent pain was the reason for their enucleation. As is to be expected, many of these eyes have the scars of operations, which had been performed to lower intraocular pressure, to remove cataracts or dislocated

TABLE 3
PATHOLOGY OF PRE-INDUCTION
NONPERFORATING INJURIES

Cause	Number
Cataract	29
Calcified	17
Dislocated Lens	5
Chronic Endophthalmitis	48
Secondary Glaucoma	32
Hemorrhage	
Organized	8
Recent	13
Detachment	
Retina	36
Choroid and Ciliary Body	6
Phthisis Bulbi	6
Ossification of Choroid	15
Staphyloma	6

TABLE 2

CAUSE OF ENUCLEATION (PRE-INDUCTION INJURIES)	
Cause	Number
Secondary Glaucoma	34
Recurrent Inflammation	16
Recurrent Hemorrhage	4
Phthisis Bulbi	3

injury. Advanced glaucomatous excavation and atrophy may develop within a few additional weeks if the intraocular pressure is considerably elevated.

The 57 eyes of this series with non-perforating injuries incurred before induction into the Army are analyzed as a group. The time interval between injury and enucleation varied considerably: the shortest was four years, the longest, 28 years. The most frequent cause of enucleation was the development of secondary glaucoma, although in many cases it

lenses, or to repair detached retinas. Thus in these eyes the effect of surgery was superimposed upon the original trauma.

Table 3 shows the most common pathologic findings in these eyes. Chronic endophthalmitis was the most frequent, with cataract, detachment of the retina and choroid, and secondary glaucoma following in that order. A great variety of degenerative and late inflammatory changes were recorded, including pig-

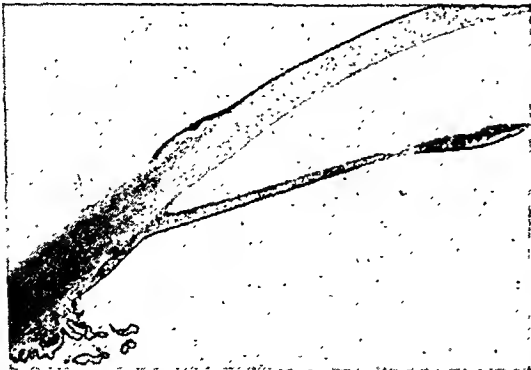


Fig. 13 (Rones and Wilder). Peripheral anterior synechia. Atrophy of the iris. $\times 20$. A.I.P. Negative No. 90129.



Fig. 14 (Rones and Wilder). Atrophy of the iris. Marked ectropion uveae. $\times 65$. A.I.P. Negative No. 90173.

mentation and hyalinization of the anterior-chamber angle meshwork, atrophy of the iris (figs. 13, 14), pupillary and cyclitic membranes (fig. 15), proliferation of the ciliary and retinal pigment



Fig. 15 (Rones and Wilder). Ossification of a cyclitic membrane around the incarcerated lens capsule. $\times 12$. A.I.P. Negative No. 90168.

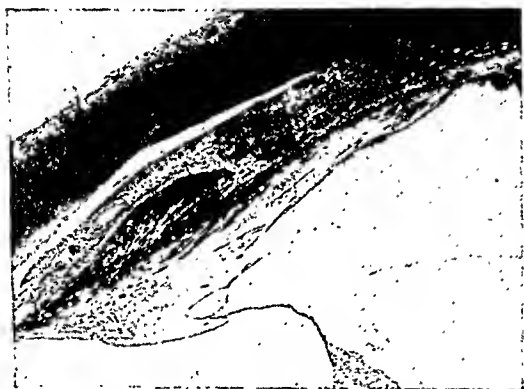


Fig. 16 (Rones and Wilder). Proliferated pigment epithelium in a cyclitic membrane. $\times 50$. A.I.P. Negative No. 90176.



Fig. 17 (Rones and Wilder). Atrophy of the ciliary body. $\times 70$. A.I.P. Negative No. 90174.



Fig. 18 (Rones and Wilder). Drusen on the lamina vitrea. $\times 50$. A.I.P. Negative No. 90171.



Fig. 19 (Rones and Wilder). Ossification of the posterior choroid. $\times 6$. A.I.P. Negative No. 90167.



Fig. 20 (Rones and Wilder). Atrophy and gliosis of the retina. $\times 165$. A.I.P. Negative No. 90165.

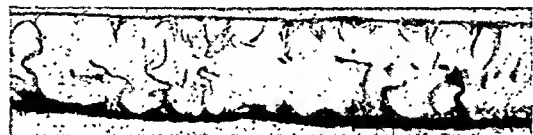


Fig. 21 (Rones and Wilder). Cystoid degeneration of the retina. $\times 120$. A.I.P. Negative No. 90144.

epithelium (fig. 16), atrophy of the ciliary body (fig. 17), colloid excrescences on Bruch's membrane (fig. 18), ossification of the choroid (fig. 19), hemorrhages and obliterative vascular changes in the retina, and retinal gliosis (fig. 20), and cystic degeneration (fig. 21).

The cases in this series that held the greatest interest for us were 20 in which inflammatory reactions followed contusion injuries not complicated by operative

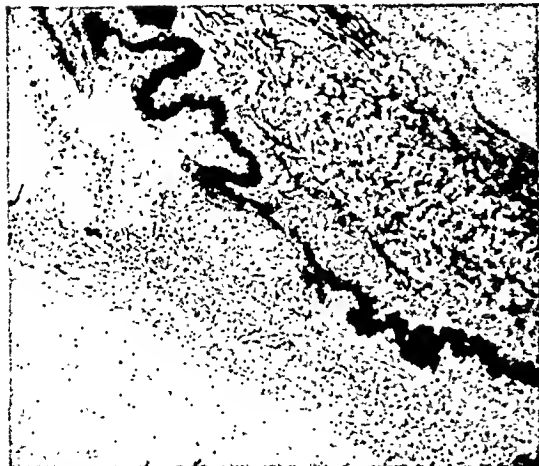


Fig. 22 (Rones and Wilder). Granulomatous cyclitis. Nodular aggregations of epithelioid cells in the vascular layer and epithelium. $\times 95$. A.I.P. Negative No. 90148.

procedures. Purulent endophthalmitis was encountered twice, both times in eyes with traumatic laceration of the optic nerve. Within a period of two weeks, purulent keratitis had developed, as a result of exposure or of neurotrophic disturbance. In the first case the purulent reaction extended into the anterior chamber and involved the iris. Here the inflammation was chiefly confined to the anterior segment, although there were some leukocytes in the vitreous hemorrhage and around the vessels in the orbital tissue. The second case exhibited a ring abscess of the cornea, with purulent exudate in the anterior chamber extending into the anterior vitreous and back along the retina. The purulent reaction involved the optic nerve and its sheaths. The mechanism which produced the purulent endophthalmitis is easily comprehended; it undoubtedly proceeded by direct extension from the purulent corneal inflammation and was in no sense a blood-borne infection.

A granulomatous inflammatory reaction was seen only once, and then in the case of a soldier with a positive Kahn reaction. The history was that following contusion of the eye, recurrent inflamma-

tion set in and a complicated cataract developed, passing over into phthisis bulbi. Pathologic examination showed dense scar tissue occluding the pupil and forming an adhesion between the cornea, the iris, and the cataractous lens. The ciliary body and its processes were the sites of a granulomatous inflammatory reaction, in which foci of epithelioid cells with occasional giant cells were rather sparsely surrounded by lymphocytes and plasma cells (fig. 22). The interpretation of this lesion raised certain questions. Was there a quiescent focus in the ciliary body which was stirred into activity by the trauma? Did trauma provoke the granulomatous lesion in an individual with systemic syphilitic disease? It is impossible to answer positively, for the problem is still in dispute in medicolegal spheres.

Active endophthalmitis was manifested in an eye enucleated seven weeks after a gun-powder explosion. There was dense lymphocytic infiltration around Schlemm's canal, with lymphocytes and plasma cells around the vessels of the intrascleral plexus and in the spaces of Fontana (fig. 23). Chronic inflammatory



Fig. 23 (Rones and Wilder). Active endophthalmitis with lymphocytes and plasma cells in the iris, filtration angle, and spaces of Fontana. Aggregation of lymphocytes around the canal of Schlemm. $\times 160$. A.I.P. Negative No. 90141.

cells and polymorphonuclear leukocytes clung to the posterior surface of the cornea and to the anterior surface of the iris. Chronic inflammatory cells infiltrated the iris, the ciliary body, the inner layers of the retina, and the nerve head. There was perivascular lymphocytic infiltration in the retina (fig. 24) and nerve head (fig. 25), with a few polymorphonuclear leukocytes in the inner layers of the retina. The intensely cellular nature of the inflammatory response is in marked contrast to that seen in a number of other cases, and led us to regard the condition in this case as a response to infection.

In 16 cases in this series the inflammatory response was definitely a reaction to the tissue trauma and subsequent hemorrhage. These cases of traumatic uveitis appear to be more severe than the inflammations resulting from infections and more frequently lead to enucleation, either because severe inflammation recurs or secondary glaucoma ensues. In this series six eyes were enucleated because of glaucoma, while ten were removed for recurrent iridocyclitis. The mechanism of production of the inflammatory lesions is not simple. Unquestionably the injury and destruction of tissues can liberate toxic substances which induce an inflammatory response. In the same way, intraocular hemorrhage can act as an exciting agent. There are two less likely factors which nevertheless have



Fig. 24 (Rones and Wilder). Lymphocytic periphlebitis in the retina. $\times 130$. A.I.P. Negative No. 94128.



Fig. 25 (Rones and Wilder). Lymphocytic perivasculitis in the optic-nerve head. $\times 60$. A.I.P. Negative No. 90142.

their proponents; namely, reflex nerve irritation and allergic sensitivity to dispersed uveal pigment or lens proteins. In two of these cases there were enough infiltrating eosinophils to suggest an allergic factor. In the remaining cases the inflammation was predominantly in the anterior segment in 12; in the posterior segment in two. The paucity of cellular response in such traumatic uveitis without penetrating wounds was in contrast to the cellularity of infectious uveitis. Lymphocytes and plasma cells were the dominant cell types, and they were scantily infiltrated through the iris, ciliary body, or choroid. These cells were also noted in the anterior chamber, on the posterior corneal surface, and in the vitreous, particularly around the ciliary processes. The exudative response to inflammation in these cases was more marked than the cellular, and was manifested by the formation of anterior and posterior synechiae, together with pupillary and cyclitic membranes. The pigment layers of the iris, ciliary body, and retina simultaneously exhibited areas of degeneration, with scattering and phagocytosis of pigment adjacent to areas of extensive proliferation of the fixed chromatophores.

SUMMARY

This report has dealt with 104 cases of nonperforating ocular injuries in sol-

diers. Forty-seven eyes were injured during combat or training. The interval between injury and enucleation varied from less than one day to $2\frac{1}{2}$ years. In these eyes, hemorrhage was the most frequent finding, although nonpurulent endophthalmitis, detachment of the retina, and secondary glaucoma also were often noted. Injury to eyes of 57 soldiers had preceded induction into the Army. The shortest interval between injury and enucleation in this group was four years and the longest 28 years. Chronic endophthalmitis was the most frequent finding, with cataract, detachment of the retina and choroid, and secondary glaucoma following in that order. A great variety of degenerative and late inflammatory changes were recorded.

An inflammatory reaction was present in 20 cases in which no operation had been performed. Purulent endophthalmitis in two of these had resulted from intraocular extension of purulent keratitis. A granulomatous inflammatory reaction was observed in the ciliary body and

processes of a third. The most striking cellular response was observed in a fourth case, in which there was active endophthalmitis, with dense lymphocytic infiltration around Schlemm's canal and chronic inflammatory cell infiltration in the iris, ciliary body, retina, and nerve head. This reaction was regarded as a response to infection. In the remaining 16 cases the inflammation was clearly a response to tissue trauma and subsequent hemorrhage, although in two the number of eosinophils in the infiltrate suggested an allergic factor. The inflammatory process was chiefly in the anterior segment in 12 cases, and in the posterior segment in two. The paucity of the cellular response was noteworthy; lymphocytes and plasma cells were the dominant cell types. On the other hand, the exudative response was marked and resulted in the formation of anterior and posterior synechiae together with pupillary and cyclitic membranes.

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SOME OBSERVATIONS ON THE SURGICAL TREATMENT OF THE EXTRAOCULAR MUSCLES*

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It is interesting and useful to look back over one's experiences and efforts in any field of endeavor, and try to analyze and evaluate them. In doing surgery on the muscles of the eyes, we all have our successes and also failures. Our successes are a most gratifying reward, while our failures are a disappointing stimulus encouraging us to eliminate our imperfections. I have the feeling that it is often from our unsuccessful cases that we learn the most. The constant search for the causes of failures goads us on to improvement. In this paper I am making no report of percentages of successes and failures. Many careful and excellent analyses of results already have been made, and I would anticipate that our figures would closely parallel those of previous studies. I would rather discuss factors and themes concerning surgery of the muscles of the eyes and the possible relationship of such factors and themes to success or failure.

UNDUE CONSERVATISM A HANDICAP

As number one in my own causes of failure I would list undue conservatism. By this I mean hesitation to operate when surgery is indicated and, more important, not being radical enough in my procedures while operating. Although this may well be a personal fault, I have observed it to be a frequent one among other surgeons operating on muscles of the eyes. My generation of ocular surgeons was brought up that way. It was the natural result of coming into ophthalmic surgery after the period of disastrous "free"

tenotomies of the ocular muscles. The operation of recession and the various forms of satisfactory shortening operations had not been perfected, and we were greatly handicapped by inability to operate on the eye muscles safely, accurately, and yet adequately. The situation made us too conservative in our surgical approach, and I for one have had great difficulty in overcoming it.

At the present time there is no need for this excessive conservatism in respect to when to operate and how to operate. The operation of recession has become thoroughly proved and established. It is a simple and safe operation, capable of control by measurement, and can be performed on the eyes of young children and also adults. Likewise, various simple, safe, and accurate resection operations are in use for eyes of persons of any age. The use of absorbable gut sutures has further simplified operation and post-operative care. Also, general anesthesia for young children and adults has progressed to a point of minimal danger and minimal operative annoyance. Therefore, we need not be inhibited as to when to operate or how to operate because of doubts as to safety and accuracy.

To me, this has been the outstanding achievement of this generation in surgery of the muscles of the eyes. The lack of this assurance was the outstanding handicap of my earlier career in this type of surgery. I am most thankful that the younger men of today and tomorrow need not be so troubled.

BE RADICAL ENOUGH TO ATTAIN OBJECTIVES

In operating, we must always have due regard for minimal trauma to tissue and

* From the Section on Ophthalmology, Mayo Clinic. Read at the 82nd annual meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.

yet we must be radical enough in our efforts to attain our objectives. Often the most radical surgery is the best and least traumatizing. In my earlier years, trying to assure minimal damage, I handicapped my efforts by small, "stingy" incisions and inadequate dissection or exposure of essential structures in the field of operation. This fault I have observed often in others.

Before reconstruction and alteration of tendons and muscles can be properly carried out, it is necessary to visualize freely and to study the tissues to be altered. Incisions heal crosswise and not lengthwise. Therefore, a long incision permitting wide exposure and free visualization is best. As pointed out by Jameson,¹ Kirby,² and others, the condition of tissues as found at operation often determines or alters the type or extent of the surgery to be performed. If we do not "open up" wide enough, we cannot see these tissues.

Again I repeat, in reconstructing tendons and muscles we must be radical enough to attain our objectives. I have failed too many times through timid or halfway measures. The early teachings of my generation to be "careful" and not to do too much caused me, at least, too many failures or partial successes. It has been my experience that overcorrections of muscular defects have been very few indeed; whereas, undercorrections or partial successes have been far too common. Personally, I should much prefer an occasional overcorrection and to reoperate for it than to wonder what to do next for frequent halfway or partial results. In truth, many postoperative conditions which are somewhat overcorrected, in our opinion as ophthalmic surgeons, are in fact most acceptable to the patient and family; whereas, many conditions which to us are somewhat undercorrected are certainly unsatisfactory to the patient, the family, and ourselves.

RECOGNIZE TYPE AND DEVELOPMENT OF TISSUES

The importance and characteristics of the various tissues encountered during an operation should be considered. The conjunctiva, or protective coat of the globe, is the point of entrance and the means of closing the surgical wound. It should be incised cleanly and widely, and at the proper points, so that it can be smoothly replaced and evenly closed with adequate sutures. Failure to do these things invites sloughing wounds, with excess granulation and poor healing. Improper conjunctival cicatrization may adversely affect the result of an operation on ocular muscles and vice versa.

Tenon's capsule is a key structure in operation on muscles of the eyes. This fact has been called to our attention by Jameson¹ and by Berens and Romaine.³ Jameson stated that Tenon's capsule could be utilized to reinforce poorly developed muscles or that it could be altered so as to lessen the action of hypertonic muscles. Berens and Romaine called attention to the necessity for preservation and conservation of Tenon's capsule; they said that, when operation is performed, Tenon's capsule over the muscles should be preserved so as to minimize postoperative adhesions of tendon and muscle to the sclera. Such adhesions, when excessive, tend to defeat our operative efforts. With the observations of these authors I am in thorough accord.

It goes without saying that the type and development of tendon and muscle encountered materially affect our decision as to what and how much to do surgically to the tendon and muscle. Preoperative ideas concerning the nature of these structures may have to be changed at the time of surgical exposure. The exact power or tension of muscles can be determined only at operation. Occasionally, anomalous insertions and attachments of

tendons and muscles to the sclera are encountered and have to be corrected. I have encountered insertions at abnormal distances and abnormal angles from the corneal limbus, accessory or double-headed tendons, abnormal formations in Tenon's capsule, and bands of tissue connecting the belly of the muscle with the sclera. All of these can be found only by wide exposure and free visualization. Some of these structures, I believe, are phylogenetic. Unless due recognition is given to these anomalous conditions and proper disposal of them is made, results will not be good.

PROPER DIAGNOSIS A PRELUDE TO SURGERY

Proper diagnosis is a necessary prelude to performance of any type of surgery. To operate without knowing what is wrong is, of course, absurd. Many times, however, in complicated cases of imbalance it seems impossible to make an exact diagnosis and we are forced to operate with an incomplete diagnosis. We should strive, however, to come to as nearly exact a diagnosis as possible before operating. As a rule, the need for operation is not urgent. When the condition is doubtful and observations are mixed, repeated observations can be made over a period sufficient, as a rule, to give us a fairly accurate idea of what is wrong before we operate. When the diagnostic picture is not clear, I prefer to delay surgery. Delay and repeated observations often clear up the diagnosis and also often change the original diagnosis for a better one.

The general theme of diagnosis of muscular anomalies has been universally established by many writers, such as Howe, Duane, Jackson, Verhoeff, Lancaster, White, and others. No one method of diagnosis is infallible. We all have our own diagnostic tricks,

In general, I believe there is no substitute for watching "eyes move" in making a diagnosis. Movement of the eyes binocularly and monocularly, and notation of their behavior with the cover test, have been my most useful procedures.

Diagnosis by means of prism measurements and cover test has not been too useful to me. Probably I have not become proficient enough in this method. However, as I have done it and watched it done by others, I have been skeptical of the findings and of the diagnosis of vertical anomalies in the oblique fields as found by this method of diagnosis alone. To my mind, the oblique fields of movement of the eyes are unstable and too many bizarre findings and diagnoses were made in the oblique fields by this method of diagnosis which I could not substantiate by observing the eyes move in these fields. At least, I have been unable to consider it safe to proceed to operate on the vertical muscles as diagnosed by screening and prism measurements alone. Undoubtedly, prism measurement and screening are useful adjuncts to our diagnostic procedures but, as Lancaster⁴ stated, "much time is expended on irrelevant, unnecessary, although not uninteresting measurements."

In a previous paper,⁵ I summarized what I thought to be the essential data in trying to make a diagnosis in muscle anomalies. These are: (1) The visual powers for distance and near vision are essential. (2) The refractive error and accommodative needs are studied. (3) The movements of the eyes in the various fields of fixation, with and without the cover test, are observed. (4) The convergent near point is taken. (5) Fusion is investigated. (6) Rest positions or phorias for distant and near vision are noted and compared. (7) Vergence powers are determined. (8) The character of any existing diplopia is studied. (9)

Symptoms are evaluated and the individual is classified medically, neurologically, and sociologically. (10) Repeated observations are made.

By a thoughtful assembling of these facts it should be possible to arrive at a definite diagnosis. Improvement in diagnostic methods based on a better understanding of the physiology of ocular motility has been of tremendous help in improving our surgical results. It is much easier to select the proper operative procedures in a given case after a refined differential diagnosis has been made.

The goal of operative treatment is to restore function, not merely to straighten eyes. When eyes are made to function properly, they will be straight. Often there are several types of surgical procedure which will straighten a pair of eyes. The best type should be the one which works toward assisting in restoration of function. Careful study of the existing state of function of the muscles of the eyes is a great aid in selection of the type of operation to be performed. I discussed this more fully in a previous paper.⁶ It is probably by a combination of all methods of diagnostic procedure that we obtain our best results. When all our data are thoughtfully and carefully assembled, the diagnostic picture will take form. I often liken the procedure to the working out of a crossword puzzle. The answer, after much doubt, suddenly becomes clear.

INDICATIONS FOR OPERATION

When imbalance is variable, particularly if it is improving, operation should be deferred. On the other hand, when imbalance is becoming worse, operation is indicated sooner. In children, particularly, and in adults, when the diagnosis is obvious and there is no favorable response to nonoperative treatment, there is no ex-

cuse for delaying operation. To delay is only to make matters worse. We have the means at hand to operate safely and accurately, regardless of age. The establishment of the recession operation, simple resections, the use of gut sutures and modern anesthesia have made such safety possible.

When strabismus is severe, particularly in children, and prolonged nonoperative measures cannot be carried out, it is often advisable to operate and put the eyes into position in which they can help themselves to straighten, rather than to allow them to be neglected.

In dealing with children it is well to remember, however, that the young, growing mechanism has an inherent tendency to correct itself with a minimum of surgical help. How many times has one seen unilateral recession of a rectus medialis muscle correct convergent strabismus in a child when one felt positive that both of these muscles would have to be recessed!

On the other hand, if the patient is an adult, minimal surgical assistance rarely is enough. Among adults one is dealing with a deformity which has become firmly fixed. It seems to me that in operating on the extraocular muscles one must be "radical and yet accurate," and must try to visualize the underlying physiologic condition and its pathologic changes.

When an eye has been operated on by a colleague for imbalance, *apparently* without success, let us not be too quick to judge his work a failure. Even if the eyes still deviate, his work may have been well done. Perhaps the degree of strabismus was too great to be corrected by operation on one eye. The other eye may have needed operation, and the surgeon may have planned his procedure that way, to complete the result. Before advising reoperation on the same eye, one should inspect its motility and scars, considering

the possibility that it has been properly operated on and all has been gained that it was possible to gain in one eye. Operation on the other eye probably will complete the correction and, if this is successful, one should insist that the patient give credit to both surgeons. I have had a number of such cases.

When muscular imbalance is complicated, as in combined lateral and vertical defects or a mixed bilateral involvement, I believe that operation for the the obvious or outstanding defect should be performed first, and that the other doubtful muscle or muscles, or the other eye, should be left for subsequent observation and possible operation later.

Often, when the worst offending muscle, muscles, or eye is operated on, the lesser offender, or the other eye, will adjust itself and further operation will not be needed or may be much less extensive than originally anticipated. It is the old principle of attention to first things first. In other words, imbalance of a vertical muscle may disappear after a pronounced defect of a lateral muscle has been corrected. Or the circumstances may be the other way around, imbalance of a lateral muscle vanishing with correction of a defect of a vertical muscle. Also, the fellow eye may straighten after the worse eye has been corrected.

Much has been said in the literature concerning inability to straighten and hold straight, by surgery, eyes with anomalous retinal correspondence. I have found this to be true only of eyes which have extreme amblyopia and marked eccentric fixation. When deviating eyes are able to fixate properly, I have found that they respond satisfactorily to cosmetic surgery, regardless of anomalous retinal correspondence. However, when deviating eyes fixate eccentrically, I have found that they do not remain straight after cosmetic surgery and that they have a marked

tendency to return toward their previous position of deviation.

TYPES OF OPERATIONS PERFORMED

I prefer that the patient be under the influence of general anesthesia for practically all my operations on muscles of the eyes. When this type of anesthesia is employed, the patient is at ease and so am I. I have found local anesthesia to be unreliable, unpredictable, and unsatisfactory. I cannot do my best work when the patient is conscious of pain. Extensive local injections disturb the field and interfere with the delicate and extensive dissections which I feel are necessary to obtain good results. The intratracheal type of anesthesia has proved highly satisfactory in my experience. If the patient is a very small child, the tube is hung in the angle of the mouth instead of being passed into the trachea.

As to the types of operation performed on the various muscles, I have finally adopted a simple form of resection or recession procedure on the rectus muscles, except in the case of the lateral rectus muscle which I still tenotomize in most instances. In tenotomizing the lateral rectus muscle, I cut only its primary insertion from the sclera, and I carefully avoid disturbing its other attachments to the sclera and capsule.

For more than 10 years I have used only plain gut sutures in all operations on muscles of the eyes. The "plain" catgut 3-0 or 4-0 has been found to be satisfactory. These sutures, in my experience, have caused the least reaction, hold sufficiently long, and do not have to be removed. All knots are tied outside the conjunctiva, so that a minimal amount of suture material is left buried. Enough extra sutures of the same material are used to close completely the conjunctival wound. This minimizes granulation.

In suturing the rectus muscles to the

sclera I use two sutures, the Worth type in resection and the Jameson ligating type in recession. Each suture includes half of the tendon. The inferior oblique muscle I tenotomize or recess at its insertion on the globe. The superior oblique muscle I have not operated on, but I am very much interested in the paper on this subject delivered by Dr. Berke⁷ at this meeting. I have found transplantation of part of the adjacent rectus muscles to the stump of a resected paralyzed fellow rectus muscle to be successful in about 50 percent of cases in which the procedure has been tried. I regard the operation as well worth while. The O'Connor cinch operation produces satisfactory results in competent hands. So far, I have not been converted to its use because the operation, as usually performed, disturbs and discards Tenon's capsule. As stated earlier, I prefer to preserve and utilize Tenon's capsule when operating on muscles of the eyes.

A mistake which I and others make occasionally while operating on muscles of the eyes is failure to isolate *all* of a tendon and muscle. Probably because of inadequate exposure, the tendon is split and only a portion of it is picked up and isolated for reconstruction. One remarks that the tendon and muscle are small and poorly developed. Of course, if only a portion of the tendon and muscle is altered, the operation will be a failure. To avoid this error, if one opens up the field of operation widely and continues dissection until there is no doubt as to the inclusion of the whole tendon and muscle, this mistake will be avoided. I mention this because I have seen it happen to me, to my assistants, and to other surgeons.

In resection of the rectus muscles, how much shall we resect? I have cause to feel that we should resect enough to take up the "slack" or "give" in the muscle. With the muscle completely freed from all

global and conjunctival attachments and held forward on the muscle hook, the Prince forceps is shoved backward until the muscle in the forceps is under distinct tension. Measurement from the hook to the back of the forceps, where the sutures go, usually shows, in the case of the lateral rectus muscle, from 10 to 11 mm. of tendon have been resected by this method. In the case of the rectus medialis muscle this measurement is from 8 to 10 mm.; in the case of the inferior rectus muscle, from 5 to 6 mm.; in the case of the superior rectus muscle, from 5 to 6 mm. If the muscle is paralyzed and flabby, these measurements will be several millimeters higher. Such radical resections really get results. I have the feeling that small resections usually are failures. Rarely in my experience has even slight strabismus been corrected by a single resection or recession operation in adults. It is usually necessary to operate on more than one muscle of the same eye or on the fellow eye in adults.

In recessing rectus tendons, I have found small recessions to result in failure. The medial rectus muscle I recess 5 mm., no more and no less. The external rectus muscle, due to its long arc of contact with the globe, is difficult to weaken. I recess 7 to 8 mm. when I perform the recession operation on the muscle. The inferior rectus and the superior rectus muscles I recess from 4 to 5 mm.

Operations on the oblique muscles have been described by Wheeler,⁸ Berens and Loutfallah,⁹ Dunnington,¹⁰ White,¹¹ Guibor,¹² Hughes,¹³ Wagman,¹⁴ and Berke.⁷ There is an increasing, and I think correct, tendency to perform radical reconstruction of these muscles so difficult to operate on. The oblique muscles are difficult to treat surgically because of their obscure and peculiar anatomic relationships. In operating on them one must be persistent in dissection and carry

it on to the point at which these muscles are as completely freed and visible as the rectus muscles are when they are operated on. When this is done, the oblique muscles can be easily altered at will. At least, I know this to be true of the inferior oblique muscle, and Dr. Berke's paper shows that it is likewise true of the superior oblique muscle. In surgical treatment of the inferior oblique muscle, I have found it best to operate on it posteriorly, at its insertion on the globe.

Results achieved by the anterior approach, through the lower lid, have been very disappointing. Results obtained from the posterior or global approach have been much better, especially since I have been recessing the tendon. Recently, I have been setting the "completely" freed tendon of the inferior oblique muscle forward on the horizontal meridian of the globe to a point 6 to 7 mm. posterior to the middle of the point of attachment of the rectus lateralis muscle. This places the attachment of the inferior oblique tendon close, or slightly posterior, to the end of the theoretic horizontal axis of elevation and depression of the globe. With the inferior oblique tendon anchored to the globe at this point, the muscle should have very little power to elevate the eye when the eye is adducted. I have found, in the few cases in which I have carried out the procedure, that this method of reducing the action of the inferior oblique muscle is very successful. I recommend that it be given a trial. To allow the inferior oblique muscle to become attached anywhere on the posterior inferior quadrant of the globe, as it will become attached after tenotomy or tenectomy, seems to me to invite failure. In anchoring the inferior oblique tendon to the sclera, I use one suture of plain catgut (4-0) tied completely around the tendon and then woven through it and left buried.

As already stated, I regard tendon transplantation to be well worth trying in the treatment of paralysis of the rectus muscles, particularly in the case of the lateral rectus muscle. In my experience, excellent motion is obtained in the paralyzed field in about 50 percent of cases in which the aforementioned procedure is performed. When the transplants fail to act, the eye will be cosmetically straight because of the "extensive" resection performed on the paralyzed muscle and the partially crippling recession performed on the opposing muscle. In the case of a paralyzed rectus lateralis muscle, I resect the paralyzed muscle a maximal amount—13 to 15 mm.—and recess the opposing rectus medialis muscle 6 mm. The technique of the operation has been described in several excellent articles by various authors such as O'Connor¹⁵ and Lutman.¹⁶

POSTOPERATIVE MANAGEMENT OF PATIENTS

The immediate postoperative management of patients who have undergone operations on muscles of the eyes seems to be an individual problem. Each surgeon has his own ideas and routine, which he feels return to good condition the eyes which have been subjected to operation. It seems to me that eyes which have been operated on recover very satisfactorily regardless of which postoperative regimen is followed.

If an eye on which an operation has been performed is kept clean "outside" and reasonably quiet for a few days, it will progress satisfactorily. Dr. Edward Jackson once told me that if the eyelids and eyelashes were kept clean, adequate drainage would be established naturally. In other words, irrigation of the eyes is unnecessary. In recent years I have followed this advice. At the Mayo Clinic our postoperative care is simple, based on

minimal disturbance of a part recently operated on. The eyelids and eyelashes are cleansed, some form of ocular antiseptic agent is instilled and pads are applied. The eyes are not irrigated. I believe that it is better not to interfere with the chemical content of the conjunctival cul-de-sac. Our postoperative reactions have been definitely less since we ceased to use postoperative irrigation of the conjunctival cul-de-sac. When marked reactions are encountered, I have found that the intramuscular injection of boiled whole milk is effective in shortening the duration of the reaction. Usually, only one injection of milk is given.

The long-range postoperative management of patients who have undergone operations on muscles of the eyes is of more interest. There is no doubt in my mind that intelligently directed orthoptic treatment must be of definite value in the postoperative care of such patients. My use of such treatment has been limited, but enough to convince me of its value. Orthoptic treatment to cure some muscular defects may make operation unnecessary and its use to assist in refining the diagnosis in all cases of muscular defects is of unquestioned value. Postoperative orthoptic treatment should be ideal to

complete a cure in selected cases, but not in all. In adults, particularly, and also in children, in the presence of postoperative diplopia and persistent fusion "inability," I think orthoptic treatment should be studiously avoided. Orthoptic treatment in such cases is not only futile, in my observation, but may also tend to fix the diplopia and to keep the patient confused and unhappy. Postoperative diplopia and fusion inability, I believe, are managed best by the absence of orthoptic treatment. It is sometimes best to let sleeping dogs lie. I have seen a considerable number of patients who had so-called horror of fusion, with eyes that had been intensively trained orthoptically after surgical treatment of muscles of the eyes. These patients have been very unhappy people. I think the best treatment for postoperative diplopia among patients who have undergone operations on the ocular muscles is to ignore it, unless the diplopia responds immediately to orthoptic treatment.

I have tried to draw, from my own experience in operating on the muscles of the eyes, some conclusion which might be useful, especially to the younger ophthalmologists interested in surgery of these particular muscles.

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NOTES, CASES, INSTRUMENTS

CLINIC FOR BINOCULAR PROBLEMS*

OBLIQUE ANISEIKONIA WITH LEFT HYPERPHORIA AND CYCLOPHORIA

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Mr. R. A. B., Case 13579, a bank clerk, aged 24 years, was first seen at the Dartmouth Eye Institute in September, 1941, and his case has been followed for five years.

His chief complaints were eyestrain and

Examination. The patient habitually tilted his head toward the right shoulder. Pupils were normal. Tension was normal to palpation. Ophthalmoscopy showed myopic conus present. Visual acuity was 20/200 in either eye, without correction.

Prescription. Previous correction had been: R.E., with a $-1.50D.$ sph. \ominus $-2.50D.$ cyl. ax. 168° , 20/50; L.E., with a $-1.00D.$ sph. \ominus $-3.50D.$ cyl. ax. 30° , 20/50. The new noncycloplegic refraction was: R.E., with a $-1.00D.$ sph. \ominus $-3.50D.$ cyl. ax. 170° , 20/30; L.E., with a $-1.00D.$ sph. \ominus $-4.00D.$ cyl. ax. 17° ,

TABLE 1
DATA ARRANGED AS SEEN BY EXAMINER

Eso. 3, L.H. 3 p.d.*	Eso. 1, L.H. 2 p.d.	Eso. 2, L.H. 1 p.d.
Eso. 4, L.H. 2 p.d.	Eso. 1, L.H. 1 p.d.	Eso. 1, L.H. $\frac{1}{2}$ p.d.
Eso. 3, L.H. 2 p.d.	Eso. 2, L.H. 1 p.d.	Eso. 2, R.H. 1 p.d.

* Prism diopters.

fatigue, frontal and temporal headache almost daily, burning and watering of the eyes, inability to see in bright light, occasional double vision (especially at night), inability to read more than one-half hour without eyestrain, fatigue and headache at the movies, inability to judge distances, floating black specks after use of the eyes.

History. He stated that he had had poor vision since childhood, but the aching and other complaints had become progressively worse the previous two years, until he was forced to change his occupation. He stated that he was never able to drive a car with confidence, driving "on nerve." He would have gone to college if it had not been for his weak eyes. The family history and past medical history were noncontributory.

20/30. Motility with the correction was: Distance: Eso. 1, L.H. 1 (prism diopter); Near: Eso. 4, L.H. 3 to 4. Amplitudes of fusion were: Distance: Convergence, 14/8 (break and recover); divergence, 7/5; vertical, $+1/0$ (base down right); divergence, $-4/3$ (base up right). Near: Convergence, 12/10; divergence, 16/12. Stereopsis was 90 percent on the Keystone DB6 card. He was given the above refractive prescription.

On February 12, 1943, the patient returned with the same complaints as before, reporting very little comfort. The refractive error, hyperphoria, and acuity were unchanged.

The diplopia fields with red glass over the right eye, as shown in Table 1, would indicate excyclophoria.

On the Bielschowsky cyclophoria device there was found right declination of 1.6 degrees, and left disclination of 5.5 de-

* From the Dartmouth Eye Institute.

grees (axis top inclining laterally).^{*} The new refractive correction was: R.E., with a $-1.25\text{D. sph. } \ominus -3.50\text{D. cyl. ax. } 170^\circ$, 1^{Δ} diopter (base up); L.E., with a $-1.00\text{D. sph. } \ominus -4.00\text{D. cyl. ax. } 17^\circ$, 1^{Δ} diopter (base down). Space eikonometer findings with this prescription were: $\times 90$: L 0.8 percent ± 0.5 degrees; $\times 180$: L 0.8 percent ± 0.5 degrees; δ : -1.0 ± 0.5 degrees. Slight overall magnification was required for the left eye and there was considerable oblique aniseikonia due to the oblique astigmatism present.

Amplitude of fusion with this correction was: Distance: Divergence, $8/6$; Convergence, $16/10$; vertical divergence, $3/2$. Near: Convergence, $16/11$; divergence, $16/12$. Stereopsis was 90 percent on the Keystone DB6 card (with difficulty).

Results. On March 28, 1943, the patient reported by letter, after wearing prisms but no aniseikonic correction for seven weeks: "The effects of the new lenses have been varied. I could not wear them steadily for two weeks, during which time I kept going back to the others when pain or tiredness occurred. At the end of two weeks I could wear them all of the time. To see anything I have to stare and adjust myself to it; however, I see more of it than ever, very clearly and very sharp. Through the outside edges I see double, the result being I must look through the center all of the time. Tiredness and discomfort come up as before, but is possibly delayed a bit. Also when tired my eyes water. This is really a new experience.

"Changing my focus takes more time than I have experienced, especially going from a broad field to a detailed surface. That is, looking relaxed about the room then returning to a typed letter before me; it appears a jumble and I have to stare at some part of it to locate my focus. In writing now, as has been the case if I center the focus in the paper, the upper left hand corner will tend to rise. Also when looking fixedly at a distant object everything about seems out of focus, which requires additional effort to bring it into clear view.

"Moving pictures are very tiring, and have brought on headache unless I was seated in the center. Slight nausea has occurred also. This occurs also when tiredness comes about. Light effects me as it always has. In the rear of a high ceilinged, brightly lighted hall, my vision to the other end is greatly cut off and the reflection of all the lights is carried on the glasses."

On April 13, 1943, he was tested on the ophthalmo-eikonometer and again on the space eikonometer. Meridional or overall aniseikonia was not found on the ophthalmo-eikonometer, but the space eikonometer detected oblique aniseikonia.

He was given 2-percent meridional aniseikonic fitovers converging out (that is, R.E., $\times 135$; L.E., $\times 45$). He reported the next day that the floors looked level, but a back wall or movie screen tipped toward him (overcorrection). There was less "confusion" on looking from one object to another than without the aniseikonic fitovers. He was, therefore, given the following aniseikonic fitovers: R.E., 1.5 percent $\times 135$; L.E., 1.5 percent $\times 45$.

On April 22, 1943, he reported by letter: "This prescription is the best I have yet worn. The confusion is greatly relieved and objects are quite distinct. Theatre curtains stand straight with a

^{*} Note that an emmetropic, noncyclophoric pair of eyes would have cyclophoria for horizontal-line objects if such refractive oblique cylinders as this are worn, and that the nearer the horizontal the cylinder axes become, the less would be the cyclophoria measured. Try this with a Maddox rod before each eye and a prism base down before one eye to make two horizontal lines. The lines will be made parallel (and thus suitable for fusion) by exocycloverision.

possible slight distortion in the upper left. That is, it pitches upward. Generally everything seems normal."

A recheck on the space eikonometer with the patient wearing the refractive prescription, the fitover, and prisms: $\times 90$: L 0.2 percent ± 0.3 degrees; $\times 180$: 0.0 percent ± 0.4 degrees; δ : 0.0 ± 0.4 degrees. The space-eikonometer test without aniseikonic fitovers showed: $\times 90$: 0.0 percent ± 0.3 degrees; $\times 180$: 0.0 percent ± 0.4 degrees; δ : -1.1 ± 0.4 degrees.

On September 28, 1943, he was given 2-percent meridional aniseikonic fitovers converging down, which he wore with comfort until July 6, 1944, when he received permanent spectacles of the same prescription.

On November 6, 1946, however, the patient returned because of a recurrence of black specks and a burning feeling in the eyes. He had also suffered some frontal headache for a few months. His general health had been excellent. On examination, the eyes were externally normal, pupils normal. Slitlamp examination showed a small nuclear dot in the lens of the left eye, with visible vitreous strands. In the right eye there was a wavy band of tissue attached at the disc and floating in the vitreous which came only slightly forward.

Subjective refraction was: R.E., with a $-1.00D.$ sph. $\ominus -3.25D.$ cyl. ax. 165° , 20/30; L.E., with a $-1.25D.$ sph. $\ominus -3.50D.$ cyl. ax. 20° , 20/30. Motility with old aniseikonic glasses of July 6, 1944 was: Distance: Eso. 1 to 2, L.H. 2 (prism diopters); Near: Eso. 2, L.H. 2. Fusional amplitudes were: Distance: Convergence, 12/9 (break, recover); divergence, 8/6; vertical divergence, $+2/1$ (base down right), $-3/2$ (base up right). Near: Convergence, 11/9; divergence, 10/8. The near point of convergence was 7 cm. Stereopsis was 100 percent on the Keystone DB6 card. The right hand and right eye were dominant. The space-

eikonometer test with old aniseikonic spectacles of July 6, 1944, showed: $\times 90$: L 0.9 percent ± 0.3 degrees; $\times 180$: L 0.4 percent ± 0.4 degrees; δ : $+0.3 \pm 0.2$ degrees. The space-eikonometer test with new refractive prescription in trial-case lenses was: $\times 90$: L 0.8 percent $+0.3$ degrees; $\times 180$: L 0.4 percent ± 0.4 degrees; δ : -1.2 ± 0.2 degrees.

SUMMARY

A 24-year-old bank clerk with disability due to severe eye strain was not relieved after two years of treatment with refractive prescriptions with or without prisms to correct the hyperphoria present. He wore the same refractive and prismatic correction with the addition of aniseikonic correction for three years with marked subjective relief of eye strain, and marked improvement of stereopsis, as measured by the Keystone DB6 card, and by sensitivity when measured on the string target of the space eikonometer. His old difficulty in focusing on any small object, especially one in motion, disappeared.

Although he left his position in the bank because of his eyes, he returned to it when he got his aniseikonic correction. His employer told us that his work was incomparably more efficient since he had worn these glasses. The recent change was small, and involved only the cylindrical correction. The measured oblique aniseikonia had not changed.

Unfortunately, the diplopia fields were not repeated with aniseikonic glasses on. However, the aniseikonic addition to the the prescription has always been symmetrical over the two eyes, and would therefore induce a change in anisophoria only by decreasing the exocyclophoria present. It is possible that this decrease in cyclophoria is as important as the effect of changing the image shape in oblique aniseikonia.

4 Webster Avenue.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

February 10, 1947

DR. J. B. STANFORD, *presiding*

RECESSION OF INFERIOR RECTUS

DR. JAMES E. WILSON reported that R. W., a youth, aged 19 years, was seen July 15, 1946. Five months previously he had received a head injury. Upon recovery the only residual symptom was diplopia. After one month's observation, the diplopia persisted in the same degree.

Vision was 20/20 in each eye, and the refractive error was negligible. Except for defective ocular motility the examination of his eyes was normal. Ocular rotations were full in all directions for the right eye but were definitely limited downward and to the right for the left eye. While the right eye fixed, the left eye was up and to the left. Diplopia fields showed that separation increased upon looking downward. While looking downward, separation was greater to the right than to the left. Image tilting and lateral separation also supported the diagnosis of paresis of the left superior oblique. Left hypertropia was measured at 10 prism diopters for distance and 15 prism diopters for near.

At operation five months after injury, a 5-mm. recession was performed on the right inferior rectus. Immediately post-operatively, there was a considerable over-correction. Two months following the operation, there was $\frac{1}{2}$ prism diopter of right hyperphoria at 20 ft. and $\frac{3}{4}$ prism diopter of left hyperphoria at 13 inches. The patient could read with comfort. There was single binocular vision in all fields except when looking extremely

down and to the right. Diplopia fields showed superimposition in all fields except when the light was carried extremely downward and to the right.

CICATRIX OF EYELIDS

DR. J. WITHERS by invitation reported that his patient M. L. C., a colored girl, aged 11 years, had spilled lye in her left eye when about two years of age and had received no treatment until first seen in the Clinic on June 28, 1946, complaining of an unsightly and tearing left eye.

She was found to have contracture of both lids of the left eye, with an extensive ectropion of the upper lid and no conjunctival sac inferiorly. The eye was a small degenerated calcareous mass whose cornea had been replaced by a matrix of veins. The lacrimal puncta were lost in the cicatrix, and there was severe epiphora with low-grade infection of the area.

On August 1, 1946, enucleation of the degenerated left eye and implantation of a glass ball were performed. On September 4, 1946, a skin graft from behind the left ear was placed in a spread incision of the lower lid, and a skin graft from the right upper lid was placed in a spread incision of the left upper lid. Adhesions of the subcutaneous tissue were cut and the ectropion was reduced and held in place by catgut sutures anchored high in the upper lid. A small mucous-membrane graft from the lower lid was placed in the new inferior conjunctival sac. A small wax conformer was placed in the conjunctival sac and two padded mattress sutures were placed to hold the lids together.

This case was presented in an effort to determine what future operations could be done to correct the epiphora and the absence of eyelashes.

ANOMALIES OF OPTIC DISC

DR. PHILIP MERIWETHER LEWIS presented two patients having very unusual nerve heads.

Case 1. V. B., a white man, aged 38 years, had no ocular symptoms except those due to a mixed astigmatism of his right eye for which he wore glasses. He was seen for a routine refraction. The vision was 20/20 in each eye. Both eyes were normal externally and the fundi normal except for the optic disc of the left eye. The disc was larger than normal with its horizontal diameter slightly greater than the vertical. At the temporal border, there was an oval-shaped, bluish-gray area, which was sharply demarcated from the rest of the disc. The patient stated that when his eyes were examined 10 years ago that the peculiar appearance of the disc was discovered. There was a moderate enlargement of the blindspot horizontally. The field was normal.

Case 2. J. B., a white man, aged 31 years, was first seen for refraction in April, 1942. He thought the vision of his left eye had been poor for many years, but he had never been examined before. The eyes were normal except for the left disc. A yellowish mass extended from the upper border temporally to just above the macula. It was quite large being about $2\frac{1}{2}$ times the size of the disc. Its surface had an irregular or shingled appearance. Corrected vision, in 1942 and in 1944, was 20/30, but it was only 20/50, in 1946. The refractive error (+1.75D. cyl. ax. 45°) had remained the same. It seemed that the growth was larger than in 1942, but unfortunately photographs were not made until recently. A very large absolute scotoma extended from the normal blind spot downward to the 90-degree meridian. The peripheral fields for form and color were normal. Fundus photographs made in August, 1946, were shown.

FOREIGN BODIES OF EYE

DR. PHILIP MERIWETHER LEWIS reported six recent cases of penetrating wounds of eyes with steel particles.

Case 1. E. H., a white man, aged 28 years, was pounding with a hammer while repairing some farm machinery when something struck his left eye. He was seen two days later on August 5, 1946, because his eye was getting sore. There was a small wound of the limbus at the 7-o'clock position with a small hole through the base of the iris. There was considerable ciliary congestion and the aqueous was a little hazy, but the fundus was normal. Vision was reduced to 20/200. X-ray pictures by Dr. Daniel Fisher showed the steel in the ciliary body just peripheral to the limbal wound. It was necessary to enlarge the wound after which the steel was removed by application of a hand magnet. It measured 4 by 2 by 1 mm. Six hundred thousand units of penicillin were given postoperatively together with one milk injection. The patient resumed work three weeks after the injury with his eye entirely quiet and vision of 20/40. The lens was clear.

Case 2. R. M., a white man, aged 30 years, was cutting concrete with a hammer and chisel on August 17, 1946, when something struck his left eye. He was seen about four hours later. There was a wound through the cornea at the 6-o'clock position and a hole through the base of the iris. The iris was congested and the pupil very small. Vision was reduced to counting fingers at three feet. X-ray pictures by Dr. D. H. Anthony showed the steel to be in the orbit below, outside of the globe. After the pupil was dilated a hole was discovered in the midline below, about 4 to 5 disc diameters below the macula. The hole was white in color, elliptical in shape and about $\frac{3}{4}$ mm. long. About nine hours after the injury, surface diathermy was

applied to the area of the scleral wound after cutting the inferior rectus from its insertion to secure proper exposure. Considerable iritis developed which subsided promptly under treatment with penicillin, milk injections, atropine, and neosynephrin. Three weeks later pigmented spots were seen all around the site of the wound. No detachment occurred, but vision was only 20/50. The lens was clear.

Case 3. C. C., a white man, aged 24 years, was using a hammer to repair a mower on August 31, 1946, when a piece of steel struck his left eye. The steel entered through the sclera at the site of the insertion of the internal rectus, but was located 16-mm. posterior to the apex of the cornea and 9-mm. lateral to the midline. Vitreous was protruding from a rather large wound, the eye was very painful and greatly swollen. Application of the giant magnet elicited no response, but on introducing the magnetic tip of a squint hook through the wound, the steel was readily removed. It measured 4 by 3 by 1.5 mm. Diathermy was applied to the sclera and to the wound. Over a million units of penicillin, foreign-protein injections, and sulfadiazine administered orally failed to prevent the development of panophthalmitis. Evisceration on the seventh day after injury was followed by prompt recovery.

Case 4. H. H., a white boy, aged six years, was watching his mother repair a chicken coop on August 24, 1946, when something struck his left eye. There was a large prolapse of iris through a penetrating wound of the cornea at the limbus, laterally. Vision was reduced to light perception. X-ray pictures showed a metallic foreign body either in the orbit or in the posterior part of the globe. The child would not permit accurate localization. Application of the giant magnet gave no result. An iridectomy was performed. Vision had improved slightly (5/200),

but the vitreous was so hazy that the fundus could not be seen.

Case 5. B. P., a white boy, aged two years, was playing in his father's blacksmith shop on August 30, 1946, when a piece of steel struck his left eye. The tip of the steel penetrated into the anterior chamber, but it remained lodged deep in the cornea. The steel was removed by magnet extraction in another city, and the eye did well for five days. It then became violently inflamed and the child was brought to Memphis. A dirty gray wound, surrounded by very hazy tissue, could be seen through the cornea in the lower pupillary area. The aqueous was cloudy, and there was marked ciliary congestion. The wound was scraped out causing the aqueous to escape. The infection was brought under control by means of foreign-protein and penicillin injections plus the usual local treatment.

Case 6. J. M., a white man, aged 53 years, was seen on September 10, 1946. About four years previously he remembered on two occasions having steel removed from his left cornea, but he could not recall how the injuries occurred. An intraocular foreign body was evidently not suspected. About a year ago the vision began to fail, but not until five days previously did the eye become red and painful.

There was a hole through the iris. Siderosis bulbi was present, the iris being a rusty yellow color instead of blue, which was the color of the other eye. A low-grade iritis was present with dense posterior synechiae which could be only partially broken with the most powerful dilators. Vision was reduced to 10/200. X-ray pictures by Dr. D. H. Anthony showed no trace of any foreign body. Evidently the metal had become completely dissolved by oxidation. Hospitalization for treatment with foreign proteins was advised, but refused.

GONIOTOMY FOR GLAUCOMA

DR. J. WESLEY MCKINNEY reported two cases of congenital glaucoma in which goniotomies were performed.

Case 1. W. M., aged seven months, was seen in August, 1945. The baby had had a trephination of each eye for congenital glaucoma three months previously. Notes made at that time stated that both corneas were large, and tension was 35 mm. Hg (Schiotz) in each eye. The fundi were not seen. The tension had remained normal for a while and was now up again, and the corneas were slightly steamy. On August 25, 1945, under ether anesthesia, the tension was 30 mm. in each eye. Goniotomy was performed on both eyes. About one third of the corneoscleral trabeculum in its nasal portion was cut with the goniotomy knife. The postoperative course was uneventful. On September 12th, tension was again up. Under vinethane anesthesia, it measured 35 mm. in the right eye and 40 mm. in the left. Eserine was used for a while but was soon stopped as the eyes seemed all right. The child, now 13 months of age, was last seen February 20, 1946. The parents stated that the child seemed to see very well. The corneas were clear and the tension was unquestionably normal to fingers.

Case 2. D. M. G., aged three months, was seen in May, 1943. At birth a diagnosis of interstitial keratitis of the left eye had been made, presumably because of the steaminess of the cornea. Examination revealed the left cornea to be large and somewhat steamy. There was a horizontal band of superficial nebulous opacity across the center of the cornea. The right eye seemed normal. Under ether anesthesia, the fundi were poorly seen with a -18 lens in each eye and appeared normal. The tension was 20 mm. Hg (Schiotz) in the right eye and 45 mm. in the left. A goniotomy was performed

cutting the corneoscleral trabeculum from the 3-o'clock to about the 11-o'clock positions. The postoperative course was uneventful. Two-and-one-half years later the tension remained normal.

THREE CASES OF "SOFT GLAUCOMA"

DR. E. C. ELLETT said that some report of this condition has been made now and then since 1924, and that Dr. Arnold Knapp's report of 10 cases, in 1932, called attention again to the condition and its association with sclerosis of the cerebral basal vessels. All cases present some impairment of vision and visual fields, optic atrophy with marginal or complete excavation of the disc, and possible radiographic evidence of calcification of the cerebral basal vessels. The intraocular pressure is not increased. The vessels affected are generally the internal carotid, ophthalmic, and the posterior communicating, but the changes are always slight and often cannot be shown by X-ray.

Operation is not indicated, and no treatment seems to help, although all cases do not progress. Dr. Ellett operated on one of his patients because the patient had been advised to have an operation by a very good ophthalmologist, and Dr. Ellett was afraid not to give him the benefit of the operation. The patient's trouble has not progressed in the 3½ years since the operation. The other patients have used miotics and have been treated with general tonics.

The last report on this condition Dr. Ellett has seen was one by MacLean and Ray to the Section on Ophthalmology of the New York Academy of Medicine in April, 1946. This was the report of a case, which has not yet been printed. He has borrowed from them the name of "soft glaucoma," which is not a good name, because everybody agrees that the condition is not glaucoma. Dr. Knapp dis-

cussed this report and is still of the opinion that the trouble is optic atrophy associated with sclerosis of the basal arteries. He spoke of the altitudinal field defect, which is characteristic, but not always present, the cupping of the disc, and the low tension. He said that the calcification of the basal vessels is not always visible to the X ray. No new suggestions were made as to treatment.

Case 1. C. D., a man, aged 68 years, was seen in January, 1944. Vision in the right eye had been blurred for a year and was getting worse. There were no other symptoms. Vision was 6/18 corrected to 6/6. The right eye had a 4-mm., slightly active pupil. There were a few lens and vitreous opacities; the nerve was white and slightly cupped. In the left eye, the media were clear; the nerve was less cupped and of better color. Tension was 20 mm. Hg (Schiotz) in each eye. The only change in nearly three years was in the fields. The tension once went to 28 and 30 mm., but has usually been 18 and 20 mm. Vision at present was 6/20 and 6/7.5+, with glasses. Dr. Arnold Knapp has kindly seen this patient several times. In June, 1944, he wrote: "I dilated his pupils with neosynephrin and found in both optic nerves: scleral ring, shallow depression, atrophy right marginal cup above. The case does not impress me as one of glaucoma but as that type of optic atrophy with shallow excavation which is probably due to interference in nutrition of the optic nerves." As the field was not taken at first on the tangent screen, the arcuate scotoma was not found. The treatment has been pilocarpine, no smoking, and a general tonic. Dr. Knapp has recently seen this patient. No X-ray studies have been made of the intracranial vessels.

Case 2. P. R., a man, aged 60 years, was first seen in 1943. Glaucoma had been diagnosed two years before. Vision in each eye was 6/6 and J1, with glasses.

Tension was 18 mm. Hg (Schiotz). Blood pressure was 175/125 mm. Hg. The patient was diabetic and was on diet. The discs in both eyes were definitely cupped. He had seen several doctors, some of whom advised operation and some of whom did not. An iridencleisis was done on both eyes in April, 1943. In October, 1946, vision was 6/7.5 and 6/6 and J1 with each eye. Tension was 13 mm. and 20 mm.

Case 3. D. H., a man aged 59 years, was seen in 1941, complaining of blurred vision especially for near for two years. He had a diagnosis of glaucoma and was using drops. The eyes were normal externally. The pupils measured 3 mm. and were active, especially the right. Vision was: O.D., 6/6 with a +2.00D. sph., and J1 with a +4.50D. sph.; O.S., 6/24, with glasses, and J20. The right fundus was normal. The left nerve was cupped in the outer half, but a crescent of good nerve persisted nasally. The vessels dipped above and below. Tension was 26 mm. Hg (Schiotz) in both eyes. Blood pressure was 118/80 mm. Hg. Fields were: O.D., normal; O.S., an arcuate scotoma above the fixation point. There was apparently some calcium deposit in the central vessels. After five years, the right eye was still normal with vision of 6/7.5 and J1 with glasses. Vision in the left eye was 6/30, but better for near. Tension was still normal. The patient was still using pilocarpine three times daily.

Daniel F. Fisher,
*Recorder for the
Eye Section*

SOCIEDAD OFTALMOLOGICA DE MADRID

December 20, 1946

DR. CORTEZO, *presiding*

The inaugural session of the term

1946-47, celebrated on December 20, 1946, was presided over by the Inspector of Health, Dr. Cortezo, representing the Director General of Health. On the platform were the president of the society, Dr. Martin Amat; the secretary, Dr. Mier; the vice president, Professor Carreras; and Dr. Mario Esteban who had charge of the inaugural lectures.

After a few brief words by Dr. Marin Amat, Dr. Mier, outlined the work which was accomplished during the previous term. He commented on the current progress and paid tribute to the memory of the departed Dr. Garcia Miranda.

HISTORY OF OPHTHALMOLOGY

DR. MARIO ESTEBAN gave the inaugural lecture. His paper was on "Past, Present, and Future of Ophthalmology." Dr. Esteban commented on the superstitious practices with which diseases of the eye were ostensibly cured in primitive times by primitive peoples, practices very similar to those which can still be observed among some tribes far removed from civilization.

The Hellenic genius showed itself in the art of curing the eyes, as in all activities. In Rome, medicine was in a low state until it received the influx of Greek culture. Tablets and seals and instruments of the oculists from the Roman Empire are still to be found in Spain.

When the Empire of the Caesars began to fall apart because of the vice and corruption of the times, there arose in sharp contrast, the sublime figure of Jesus of Nazareth. He preached virtue and taught us by His example that to cure the sick and to restore vision to the blind is a divine gift. In order to deserve it and to enjoy it we must always try to attain intellectual and moral perfection. At the fall of Imperial Rome the Arabs salvaged a culture which was about to perish. The Arabian doctors showed a strong pre-

dilection for ophthalmology, the study and practice of which were rigorously regulated.

During the middle ages, ophthalmology found shelter in the monasteries. It is well worth mentioning that during this period lived our compatriot, Pietro Hispano, Pope Juan XXI, who was an oculist and author of a work on ophthalmology.

At the coming of the renaissance, science, literature, and art were released from the classical molds of Greece and ancient Rome. Leonardo da Vinci, anatomist, artist, and creator of scientific theories, stands as a symbolic figure. During the 17th, 18th, and 19th centuries, there were continuous studies and discoveries among which the discovery of the ophthalmoscope marks a new era in the progress of ophthalmology.

At present, after 5,000 years of accumulated knowledge, ophthalmology is an extensive and profound science, but still in the stage of development. We cannot foresee the future of ophthalmology except as we can visualize it in our imagination. First there will be a period during which surgery will dominate, with bold operations in order to repair blind eyes as if they were a mechanical apparatus in which a piece has to be replaced.

At the same time there will be great advances in knowledge about diseases like cataract and glaucoma. These diseases will no longer need surgical treatment because it will be possible to prevent them and cure them by medical means. The oculists of the future centuries will read with curiosity and not without admiration the technical practices of their colleagues of the 20th century. In the future there will be experiments as a result of which the blind will be able to receive impressions of light and color. It will be possible to convert light stimuli from the

outside into photoelectrical energy which will be transmitted to the brain by other channels than the retina. This perhaps will be less spectacular than applying atomic energy to kill and destroy, but it will nevertheless be much more beautiful.

RECEIVES HEALTH DEPARTMENT AWARD

DR. DON FERMIN GALINDEZ IGLESIAS was awarded the prize of the General Department of Health. The prize of the Ophthalmological Society was declared vacant, and the president, Dr. Marin Amat, stated that it will be added to that of the term which was beginning. Finally, Dr. Cortezo, in the name and as a representative of the General Department of Health offered his congratulations to the Ophthalmological Society of Madrid for its contributions to the public welfare.

Joseph I. Pascal,
Translator.

BROOKLYN OPHTHALMOLOGICAL SOCIETY

December 19, 1946

CAMPIMETRY WITH ULTRAVIOLET LIGHT

DR. GEORGES KLEEFELD demonstrated the technique of campimetry with ultraviolet light. The theory of using luminous paint for fixation was discussed. It appears that the normals of measurement in campimetry with this technique are identical with those of the usual manner of examination. No harmful effects are attributed to the procedure according to Dr. Kleefeld. The suggested advantage is ease of visual response by the patient.

FUNDUS CHANGES IN VASCULAR DISEASES

DR. HERMAN ELWYN presented in detail the histopathologic background of:

- (1) The physiologic aging process. (2)

Arteriosclerosis. (3) Essential hypertension, benign and malignant. (4) Renal hypertension, with particular emphasis on ophthalmoscopic appearances.

ANIRIDIA CONGENITA

DR. MORRIS PINCUS presented five patients with bilateral aniridia, including the genealogy and treatment possibilities. The clinical and pathologic features are furrowed brow, narrow palpebral fissures, unusually large pupils, photophobia, poor vision, and frequently nystagmus. The apparent absence of the iris on clinical examination is due to the fact that a short stump is hidden behind the corneoscleral margin. Other ocular defects such as ptosis, muscular imbalance, corneal disturbances, lenticular anomalies, and pathologic condition of the retina are quite common. Glaucoma, as a secondary complication, is not uncommon. Several useful procedures of treatment are available. Tattooing of the outer portions of the cornea, extraction of a cataractous lens, and the wearing of an opaque contact lens, with a 3- to 4-mm., clear, central pupil, are the methods of choice. Glaucoma, as a secondary complication, can be controlled by eserine or a corneoscleral trephination.

George A. Graham,
Associate Secretary-Treasurer.

CHICAGO OPHTHALMOLOGICAL SOCIETY

November 18, 1946

WILLIAM A. MANN, *president*

CLINICAL PROGRAM

The clinical program was presented by the Department of Ophthalmology, University of Illinois.

HEMANGIOMATA OF PALPEBRAL CONJUNCTIVA

DR. M. R. FOLK presented V. H., a girl, aged 9½ months, whose parents noticed an enlarged upper left lid at birth. The family and past histories were negative except that the child was jaundiced for one month after birth.

Examination showed a smooth swelling of the left upper lid, causing complete ptosis. The swelling was more marked at the lateral aspect. The left eyeball seemed to be slightly proptosed and had a convergence of 20 degrees. There was no evidence of an inflammatory process. Palpebral and fornix conjunctiva was three times the normal size and when inverted covered the entire eye. The pupils reacted to light and accommodation and dilated evenly to 7 mm. Both discs showed normal color and arrangement of vessels. X-ray pictures of the orbit showed no demonstrable pathologic condition. Physical and laboratory findings were normal.

The patient received eight 150r X-ray treatments applied to the lateral orbital area through a field cone, following which there was some regression of the condition. No further treatment was given for one month. No further regression occurred, and the patient was again admitted to the hospital. Sodium morrhuate was then injected into the area of lesion of the left tumor and, as a result, a 2-mm. slitlike opening, not present before, was seen nasally.

VON HIPPEL-LANDAU'S DISEASE

DR. M. R. FOLK said that M. D., a 25-year-old white woman, complained of pain in the left eye and headache in the temporal region, worse after prolonged use of the eyes. There had been progressive loss of vision in the left eye in the past three months. At the age of 14 years, the patient had had poliomyelitis, from

which she recovered after six months. At the age of 19 years, she developed left hemiparesis, was hospitalized for one week, but could not walk for two months thereafter. Three years ago she had had an attack of headache, vomiting, blurred vision, and grand-mal convulsions, and has had two more convulsive seizures since then.

A neurologic diagnosis included organic brain disease, residue of left spastic hemiparesis complicated by epileptiform seizures. Arteriograms of the left carotid showed an anterior cerebellar artery filling from the left side. It appeared likely that the symptoms resulted from a cranial aneurysm similar to those found in the retina.

Vision was R.E., 1.2; L.E., 10/200. The left eye had a tendency to deviate outward but was able to maintain parallelism. The ocular movements were normal. The iris was normal. The pupils, 4 mm. in diameter, reacted to light and accommodation. The right fundus was normal. The left fundus showed the disc to be pale temporally, the margins clearly outlined, with normal arrangement of blood vessels. In the macular region a star-shaped exudate was seen. Many discrete and confluent patches near the periphery extended from the 2- to the 6-o'clock position. Beyond the macula the inferior branch of the superior temporal artery was covered by a reddish yellow lesion, 2 to 3 disc diameters in size, surrounded by a circle of flame-shaped hemorrhage. Many small saclike aneurysmal dilations were noted in the same area. The fields showed a central scotoma. Tension was normal.

MACULAR AND CHOROIDAL DEGENERATION

DR. STEPHEN W. SUKUMLYN presented E. C., a white man aged 53 years, who complained of photophobia, lacrimation, and loss of vision in both eyes for

12 years. He had been employed as a moulder, handling liquid metal, for five years.

There was a divergence of the left eye of about 20 degrees; otherwise the external findings were normal. The pupils reacted to light and accommodation. The visual acuity in both eyes was reduced to counting fingers at two feet. After homatropine retinoscopy, vision could be corrected to 10/200 in both eyes. With the ophthalmoscope, the disc of the right fundus was seen to be orange-yellow in color and the small, cupping disc margins to be hazy. The vessels were attenuated throughout their course in the ratio of 2 to 1. The central areas of both fundi were involved by large plaquelike lesions, somewhat depressed, having an irregular margin angulated at several points, with moderate disturbance of pigment along the edges. The bases of the lesions were pinkish red in color and appeared to be crossed and recrossed by a fine capillary network. The periphery of each fundus, at frequent intervals, was stippled with fine pinhead spots where the pigment migrated into the inner layer of the retina. In the right eye, above and temporally, was a pigmented threadlike structure occupying the upper outer quadrant. Otherwise the findings of the left eye were almost the same as those of the right.

Fields showed a large central scotoma, breaking through on the nasal side. Fields were taken with the 10-mm. target for white only; other colors were not recognized.

All physical and laboratory tests were within normal limits. From the history of long exposure to light of high intensity, it is possible that this might be a factor in the cause of the present findings.

GYRATE ATROPHY OF CHOROID AND RETINA

DR. STEPHEN W. SUKUMLYN said that

A. S., a white woman aged 66 years, complained of substernal pain, dizziness, and loss of vision in both eyes, with night blindness. The eye symptoms were of two years duration. There was no history of eye disease in the family.

External examination showed a large nevoid, brawny growth on the left eyebrow. Vision was: R.E., 0.6; L.E., 0.4; and could not be improved. Examination of the fundi through dilated pupils showed the lenses to be clear and the discs to be lemon-yellow in color. The margins on the nasal sides were frayed, the surfaces not elevated. Cupplings of the discs were small, deep, and centrally placed. Retinal vessels were much attenuated in the ratio of 2 to 1. In the periphery were fine threads. In the region of the disc and macula, an area of normal fundus was surrounded by a ring of atrophy, which in the periphery of the fundus was of scleral whiteness, with almost complete absence of choroidal and retinal vessels. As the ring of atrophy encroached on the central region of the fundus, the faint outlines resembled a crumbled framework of tongues, circles, and ovals, the contours being very distinct on the border of normal fundus. The condition was more advanced in the left eye.

Fields taken with the 3-mm. white target were contracted to between 15 and 10 degrees, in both eyes. The blood pressure was reported to be 240/140 mm. Hg. The dermatology department reported pityriasis rosea. Complete laboratory and physical examinations gave negative results otherwise.

The patient's eyes were dilated on several occasions, and in spite of the use of myotics after dilation, an acute bilateral glaucoma supervened for which operation was performed.

Twenty-six cases of gyrate atrophy of the choroid and retina have been reported in the literature between 1888 and 1932,

including one by Fuchs in 1895. He discussed this case in detail and gave it the term of gyrate atrophy of the choroid.

SCIENTIFIC PROGRAM

The Cover Test, presented by Dr. Hilmer Martin (by invitation).

Anomalous Correspondence, by Dr. Beulah Cushman.

A Therapeutic Routine in Cases of Strabismus, presented by Dr. John Hitz (by invitation).

Richard C. Gamble,
Secretary.

COLORADO OPHTHALMOLOGICAL SOCIETY

November 16, 1946

DR. JOHN C. LONG, *presiding*

RETROLENTAL FIBROPLASIA

DR. HUGH KINGERY (by invitation), as a preliminary to the discussion of retrolental fibroplasia, outlined the embryology of the vitreous. He explained that this body is not histologically a tissue but is a secretion of many of the ectodermal and mesodermal contiguous structures. The primary vitreous is deposited immediately behind the lens body and there remains, becoming surrounded by the secondary and tertiary vitreous bodies. The generous blood supply of this primary vitreous comes from the central artery and normally degenerates along with the rest of the hyaloid arterial system.

DR. RALPH W. DANIELSON presented a paper on what the late Dr. T. L. Terry called retrolental fibroplasia and on what Dr. A. B. Reese has designated as persistence of primary vitreous. This material was generously furnished him personally by these authorities. The essential pathology of the condition is a persistence of some part of the tunica vasculosa lentis, a hyperplasia of this tissue, and a hyperplasia of the fibrillar structure of the embryonic primary vitreous. It must be differentiated from retinoblastoma and various other forms of pseudoretinoblastoma. He reported seven such cases seen in Denver and described an attempted biopsy made on one. The collapse of the globe from loss of fluid helped to prove the case to be other than one of a glioma. No treatment has been very successful; prophylaxis seems to offer the only hope. A variety of methods for examination for differential diagnosis was outlined.

Discussion. Dr. Harry Gordon (by invitation) said that there was no question of this condition being associated with premature births. Since five percent of all births are premature and since more and more of these babies will be saved, more cases of this disease will be seen.

Dr. Danielson, in closing, suggested that all these babies be examined under general anesthesia and that a fixation forceps be used to move the eye. The mydriatic of choice would be $\frac{1}{4}$ -percent homatropine.

Morris Kaplan,
Secretary.

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PERIMETRY

According to the findings of the American Board of Ophthalmology, one of the subjects in which the candidates for the certificate are most weak is perimetry. This soft spot in the training of an otherwise well-rounded ophthalmic candidate includes not only the theoretical but, what is more surprising, the practical aspects of the subject as well. The majority of can-

didates showed themselves to be especially poorly grounded in the technique of taking a peripheral field. In the practical examination, many paid no attention to the important points of seating the patient properly, or of making him comfortable, or of instructing him as to what was expected of him, and so on. Many of the candidates had been in practice for a number of years. A number confessed to

the possession of poor pieces of apparatus; some were content with a hand perimeter, and not many had any form of central-field apparatus. Illumination, the size of the test objects, and distance from the screen seemed to be of little importance to them.

The taking of visual fields began with Thomas Young, in 1801, and was later elaborated by Purkinje, in 1825. Von Graefe, in 1855, and Aubert and Förster, in 1857, used perimetric studies of the gross defects in the field of vision diagnostically, but it remained for Bjerrum, in 1889, to develop a method for the accurate taking of the central fields which led to the invention of the Bjerrum screen. Thanks to the profound studies and analyses of Roenne, Sinclair, Traquair, Walker, Peter, and many others, we are in a position today to profit by the study of visual fields of our patients in a measure unheard of 40 years ago.

The interpretation of a visual-field defect is thus almost an exact science. The taking of a visual field remains, and always will remain, an art. As Duke-Elder has so ably said: "Its essential drawback is its subjective nature, for the examiner is always dependent upon the mentality and cooperation of the examinee, and the difficulties with the unintelligent patient who does not cooperate are almost insuperable. To these physical characteristics, which cannot be controlled and are difficult to estimate, must be added the personality of the examiner himself, as well as physical considerations, such as the size of the pupil, the condition of the refractive media, the illumination, and a host of other factors. It is essential, therefore, that in any method employed, simplicity should be the keynote, and the complexity of the apparatus or overdue attention to minute detail in technique should never be allowed to govern the interpretation of the results."

The neurologist or neurosurgeon, despairing of getting a good and fairly accurate perimetric study of his patients from his ophthalmologic colleague, has, beginning with Cushing, tended to rely more and more upon himself in this matter. However, judging from a perusal of perimetric charts made by the average neurologic resident, the ophthalmic house officer still has a slight edge on his neurologic colleague in this affair. This gives us small comfort, for the work of neither in this line is completely satisfactory.

It is entirely up to us to develop our interest, technique, and skill in perimetry to the point where we excel in this endeavor and are able to convince our neurologic colleagues that only we are capable of making proper perimetric and campimetric studies and that we are on a par with them in the matter of interpretation of the defects uncovered.

How has it happened that we have slipped and are slipping in a vitally important and significant diagnostic test? What accounts for the poor showing of our candidates? The answers to these questions are no doubt complex, but probably lie in the fact that we are too busy doing other things with our patients to bother with a tedious, time-consuming, and often irritating test, regardless of its importance. Thus it happens that many, if not most, of our top-flight ophthalmologists are satisfied with either a rough confrontation test or delegate the perimetric studies to an office assistant, who frequently is a lay person. This, of itself, is not bad provided the technician is thoroughly trained in the art of taking peripheral and central fields, although no one can do it as well as the ophthalmologist himself. The evil arises in the fact that these busy ophthalmologists of skill and renown are often teachers of ophthalmology in our schools and hospitals,

or are the preceptors of the young ophthalmologist. Having given up for many years the taking of fields of vision themselves, they are not interested and are usually very rusty in matters of the technique and the art. They, therefore, are not fit to instruct the young except in the interpretation of the findings.

The solution of this difficulty lies in the awareness on the part of the staff of the department of ophthalmology in our schools and especially in our hospitals of our failure in this field and then the correction of this failure by placing proper emphasis on instruction courses in perimetry. There is generally some member of the staff of every institution who is not only interested in perimetry but who is often an enthusiast. He should be encouraged and supported by designating him the instructor and by giving him the facilities and the responsibility not only for training the student in this difficult art but also for pointing out to him its great clinical significance.

It would seem that modern methods of visual education are particularly well suited to teaching this subject. Training films, sponsored by the Academy of Ophthalmology and Otolaryngology, would be of the greatest value to the teacher and student alike. It is the duty of every department of ophthalmology to conduct a stimulating and satisfactory course in perimetry—a course open not only to the residents and postgraduate students but also to practicing ophthalmologists who feel the need for such a course.

Judging from the poor quality of perimetry performed by the average practicing ophthalmologist and particularly by those who do ear, nose, and throat work in addition, as shown by the records of the Board, such a course is urgently needed in all parts of our country.

Derrick Vail.

FASHION AND SPECTACLES

It is hardly surprising that spectacle lenses and frames are subject to the same sort of vagaries as other articles of dress. The variations are by no means always made for the benefit of the patient, although often at his expressed desire, whether for the purpose of imitating his friends and neighbors, or because he is told by the counter optician that "this is the latest style."

It is a far cry from the bifocal combination which Benjamin Franklin ordered of his Paris optician to the various types of invisible bifocals of today. On the whole it is probable that the great Philadelphian was at least as comfortable in his split bifocals as the citizen of today in his more or less invisible and much more expensive one-piece lenses. But no one cares to make himself conspicuous with the type of lenses worn by Benjamin.

Nothing perhaps is more conspicuous in school children of the modern United States than the desire to be conspicuous, and quite in harmony with this tendency, if with nothing else, is the fad for eccentric shapes in spectacle frames, particularly the use by girls of a type of plastic frame which somehow suggests a pair of cow horns.

The spirit of Henry Ford appears to have taken hold of the industry of manufacturing spectacle frames, at least so far as quantity production is concerned. Although for some people the use of side pads may represent a great improvement over the old-fashioned saddle bridge, there are a good many forms of facial architecture for which the saddle bridge is vastly preferable. Yet today it is almost impossible to obtain the saddle-bridge frame. The completeness of the change indicates a lamentable lack of consideration for public interest as against profit-making.

It is refreshing to see that some of these modern trends in the wholesale optical industry can arouse scruples in the minds of optical dispensers. Mr. William Frank Davis, of the firm of John Wooster and Company, San Francisco, under the title "Remember the Oxford?" asks in *Guildcraft* (organ of the Guild of Prescription Opticians of America, February-March, 1947, page 28) the following questions: "What has happened to the theory that a pair of glasses should be made as inconspicuous as possible on the patient's face?" "What has happened to the theory that in fitting a spectacle frame balance is achieved in the correct fitting of the bridge, and not in attempting to hold the lenses in position by temple tension?" "What has happened to the theory that lens size is controlled not only by the difference between the pupillary distance and the distance between lenses, but by the conscious idea of form and appearance, so that the patient will not have the appearance of an owl?"

We may further ask how much has been gained by the tendency toward use of very large lenses, much larger than would be indicated by the patient's pupillary distance. As a matter of personal comfort, it would be much more satisfactory to use small lenses, because increase in the weight of spectacle lenses develops almost in geometric proportion to the diameter of the lens. When, a few years ago, some of the more conservative and independent among us ventured to criticize this tendency to large lenses, we were assured that its aim was to give the patient a larger field of vision. It was fruitless to point out that the ordinary habits and purposes of vision utilize only 10 or 15 degrees at the center of the lens. Today we are urged to have our aphakic or high hyperopic or myopic patients wear

"lenticulars," in which not more than one half of the total area of the lens is ground to prescription, the remainder of the piece of glass being entirely without value from the optical point of view. How much more comfortable many of these patients would be, without any loss of visual efficiency, with the antique type of small lens! Mr. Davis is certainly correct in maintaining "that we still have a responsibility to the eye physician and the patient." "We cannot ride," he adds, "on style and style alone."

The tendency to sacrifice efficiency to style (largely imposed by manufacturers) renders it more frequently difficult for the ophthalmologist (or optometrist) to be certain that the pair of spectacles delivered to the patient will correspond exactly with the prescription formula. The larger the lens the less likely is its distance from the eye to favor its harmonizing with the prescription. The plastic frame lends itself particularly to poor fitting, so that, the original selection of the frame having been slovenly, the finished product frequently slides too far down the nose and often the frame rests inelegantly, and to the patient's discomfort, on the cheek. The bows, at first snug, often become so loose that the patient is discouraged from wearing his correction or wears it with inaccurate results.

Perhaps the optical trade would be well advised to hold a national conference for the purpose of considering steps necessary in the public interest rather than solely in that of the manufacturer. Perhaps, too, some of the money spent in pretentious advertising of styles in frames and lenses could be advantageously employed in giving the public information concerning the principles involved in the fitting of spectacle lenses.

W. H. Crisp.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
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| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
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| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

1

GENERAL METHODS OF DIAGNOSIS

Carlevaro, G. The foveoscope. *Rassegna. Ital. d'Ottal.*, 1943, v. 12, May-June, p. 187.

Carlevaro has constructed an instrument which he names the foveoscope and describes it in detail. It is used to determine the degree of central vision, both monocular and binocular, when one varies the optical adaptation of the eye by means of test lenses. Theoretical considerations are offered as to the use of the instrument to determine the light sense, visual acuity and degree of binocular vision. Eugene M. Blake.

Katz, I. H. A focusing flashlight. *Amer. Jour. Ophth.*, 1947, v. 30, July, p. 911. (3 figures.)

Krimsky, E. A new prism holder. *Trans. Amer. Acad. Ophth.*, 1947, March-April, p. 297.

The single prism holder designed for standard square prisms consists of an

adjustable housing connected with a vertical rod which the patient holds against the cheek. In the multiple prism holder, several square prisms with their bases in different positions may be inserted. (1 figure.) Chas. A. Bahn.

Marquez, E. Garcia. Refracto-retinometry with the direct image. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, Feb., pp. 126-133.

The devices for measuring fundus lesions are reviewed, and his own instrument is described. It consists essentially of a modified slit-lamp ophthalmoscope, with an incorporated round reticule, which is projected upon the retina. The reticule has concentric circles, calibrated so that it can measure lesions 1/16 mm. in size. The instrument can also be used as a refractometer by calculating the axial refractive error from the degree of displacement between the focusing lens and the condenser system. (4 illustrations, 1 table.)

Ray K. Daily.

Schepens, C. L. A new ophthalmoscope demonstration. *Trans. Amer. Acad. Ophth.*, 1947, March-April, pp. 298-301.

In this binocular instrument which was designed especially for studying detached retinas, but which is useful for all ophthalmoscopy, the indirect method is used. The illuminating unit is mounted on a stand and the observing unit is fixed by a vertical head band. The former consists of a 12-volt globe mounted in an adjustable housing to which an angled mirror and observation window are attached. The latter consists of a prism binocular magnifier with a slide for supplementary lenses and an 18-D. lens which is held in the left hand of the observer. (4 figures.)

Chas. A. Bahn.

Thorpe, H. E. A Method for visualizing the anterior segment of the globe by stereoscopic roentgenography. *Trans. Amer. Acad. Ophth.*, 1947, March-April, pp. 296-297.

A Comberg glass localizing shell is used and the outline of the eyeball is marked on the X-ray plate. (1 figure.)

Chas. A. Bahn.

2

THERAPEUTICS AND OPERATIONS

Bakker, A. The action of sulphanilamide on rabbits' lenses in vitro. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 216-219.

Reports of experiments show that sulphanilamide, not above the therapeutic level, is quite harmless for implanted lenses of rabbits. When the concentration is elevated, it is noted that the lenses from very young rabbits became opaque; however the toxicity of sulphanilamide for lenses from adult rabbits is less pronounced.

O. H. Ellis.

Basterro. A new suture material. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, Feb., pp. 173-174.

Cortes advocates the use of nylon sutures in surgery of the lids and lacrimal sac. They are not hygroscopic and are well tolerated by the tissues, to which they do not adhere. They are slightly more rigid than silk or cotton, and have to be tied with care, lest they cut the tissues within the knot.

Ray K. Daily.

Berens, C. An illuminated retractor speculum. *Trans. Amer. Acad. Ophth.*, 1947, March-April, p. 302.

This instrument consists of an electric bulb mounted in a handle as in an ordinary hand ophthalmoscope. A regular or Arruga tip may be attached. It is designed especially for retinal and muscle surgery. (1 figure.)

Chas. A. Bahn.

Berens, C. The Luckiesh-Berens tangent screen illuminator. *Trans. Amer. Acad. Ophth.*, 1947, March-April, pp. 304-305.

This device is essentially a large frame mounted on a stand. It supports the chin rest and illuminating unit for the tangent screen. The fluorescent illumination with a color-temperature of 4,500 degrees may be varied from 1 to 100 footcandles. (1 figure.)

Chas. A. Bahn.

Berens, C. Two accommodating rules of opaque plastic. *Trans. Amer. Acad. Ophth.*, 1947, March-April, p. 303.

The longer rule is 50 cm. long, contains a slide marker, and is calibrated in inches, centimeters, and diopters. The shorter rule has a string on one end for measuring the near point of convergence. (1 figure.)

Chas. A. Bahn.

Bitran Berechit, David. Local penicillin in ophthalmology. *Arch. Chilenos de Oft.*, 1946, v. 2, May-June, pp. 157-177.

The drug was used locally in a total of 153 cases. The author concludes that the drug should be used locally in ophthalmology and not systemically. It may be used in collyria, ointments, and subconjunctival, retrobulbar, intracorneal, palpebral, sacular, anterior chamber, and intravitreal injections. It should be used in combination with novocaine in high concentrations, and may be employed as a preventive of infection in cases of wounds and operations, when the infecting organism is sensitive to penicillin. (References.)

W. H. Crisp.

Cutler, N. L. A new type of basket implant for use after enucleation. *Surg., Gynec. and Obst.*, 1947, v. 84, April 15, pp. 792-798.

A basket (11 by 15 mm.) made of lucite (methyl methacrylate) with fenestrated sides to permit the invasion of tissue and a lucite button (5 by 8 mm.) with four holes to tie the three double-arm sutures are described. After surgery a plastic retainer is used to reduce edema and conjunctival prolapse and to help keep the basket centered. Two baskets placed in the sclera after evisceration caused extreme edema with no advantage in motion. A patient studied eight and a half months after operation showed that all the muscles became attached near the rim of the basket. Sutures are placed so that Tenon's capsule and the conjunctiva are well closed. The final prosthesis is fitted after two or three weeks. In 100 patients there was much more extensive motility than after other procedures. (13 illustrations.) H. C. Weinberg.

Duguid, J. P., Ginsberg, M., Fraser, I. C., Macaskill, J., Michaelson, I. C., and Robson, J. M. Experimental observations on the intra-vitreous use of penicillin and other drugs. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 193-210.

The authors present experimental results on the intravitreal injection of penicillin and other drugs. Commercial penicillin, sodium sulphacetamide, marfanil and V. 335 (p-methyl sulphonyl benzylamine) introduced into the vitreous were highly damaging to the retina, to a degree which excluded their use clinically. Sodium sulphacetamide and pure penicillin either together or separately in the vitreous were found to diffuse rapidly into all parts of the eye, and the vitreous acted as a depot replenishing the drug lost from the other tissues. It was found that pure sodium penicillin was highly effective in the control of infections of the vitreous body, and that chemotherapeutic levels could be maintained by intravitreal injections of 2,000 units every two days. Pure sodium penicillin caused minimal retinal destruction, and its use seems indicated and justifiable in certain cases of infection.

O. H. Ellis.

Dyar, E. W. A corneoscleral suture. *Amer. Jour. Ophth.*, 1947, v. 30, July, pp. 909-910.

Gandolfi, C. Vitamins C and K in ocular hemorrhage. *Rassegna Ital. d'Ottal.*, July 1943-Dec. 1945, v. 12-14, pp. 504-515.

Gandolfi has found vitamins C and K helpful in many forms of ocular bleeding. He believes that vitamin C is indicated when there is vascular fragility which is due to a relaxation of the endothelium. In vitro it aids in coagulation, probably by activating thrombin and

inhibiting antithrombin. Vitamin K augments the action of prothrombin and thus increases the coagulability of the blood. The need of determining by laboratory tests which vitamins are lacking in each patient is emphasized. Three illustrative cases are reported.

Eugene M. Blake.

Grossmann, E. E. Stability of penicillin in ophthalmic solutions. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 167-174.

The stability of penicillin was studied when dissolved in isotonic salt solution, distilled water, white ointment, Aquaphor, cod liver oil, olive oil, blood plasma, and blood serum. It was found that the ointments remained potent as long as the solutions but that the loss was rapid and wasteful. Cod liver oil and especially olive oil suspensions proved more effective than either the ointments or the saline solutions. Solutions of penicillin in blood plasma gave the best results. The solution in serum, while not so effective as the plasma solution, nevertheless, proved better than any of the ointments, oils or solutions. In general, clinical results have been good with all the penicillin mixtures when used in the treatment of properly selected patients and when applied frequently.

John C. Long.

Haas, L. R. Intraocular penicillin in severe intraocular infections. *Jour. Amer. Med. Assoc.*, 1947, v. 134, June 7, p. 527.

The author reports a case of corneal perforation with hypopyon and plastic exudate, that responded to the injection of penicillin (500 units per cc.) into the anterior chamber as well as intramuscularly, and atropine locally. Vision of the affected eye was restored to 20/25.

Irwin E. Gaynon.

Hruby, K. Ophthalmologic experiences with penicillin. *Wien. Klin. Wchnschr.*, 1947, v. 59, April 18, pp. 240-244.

The author reports his first experiences with penicillin which has been used in the Second Eye Clinic of Vienna since 1946. By instillation of penicillin drops of 250 units per cc. every 10 minutes for three hours, 32 out of 37 patients with ophthalmia neonatorum were cured. The continuance of this treatment for a total of 12 hours is recommended. In inflammations of longer standing a concentration of 500 units per cc. is advisable and when the cornea is involved subconjunctival injections of penicillin and, in addition, some of the older methods of treatment are indicated. Penicillin was also valuable in postoperative pyogenic infections, especially in infections after cataract extractions. No eye was lost after the treatment with penicillin was introduced, which is in sharp contrast to the experiences before its introduction. Hruby recommends early subconjunctival injections of penicillin (20,000 units per cc.) combined with puncture of the anterior chamber, intramuscular milk injections, short wave treatment, and sulfanilamide medication. Penicillin was also used as a prophylaxis before surgery by instilling a 500-unit solution for several days. When complications arose during the actual operation, a subconjunctival injection of 20,000 unit penicillin solution was done at the end of the surgical procedure. This improved the surgical results considerably. Penicillin was also beneficial in perforating injuries, blepharitis, corneal ulcers and in a case of a metastatic ophthalmia. (Literature.)

Max Hirschfelder.

Knapp, F. N. Treatment of ocular tuberculosis. *Wisconsin M. J.*, 1947, v. 46, June, pp. 599-603.

The primary treatment of ocular tuberculosis consists of sanatorium regimen or else rest in bed, and high-vitamine and high-caloric diet. In using radium, beta rays may be used for the anterior segment and gamma rays for the more deep seated lesions, weekly for three or four weeks in quantities that vary from 10 to 40 percent of an erythema dose. Gold sodium thiosulfate is administered twice weekly. One starts with 10 mg. and increases to 50 mg. in 5-mg. steps for 50 to 60 injections. Typhoid H antigen and typhoid vaccine may also be used. The Mantoux test and the use of old tuberculin for therapy is discussed. The importance of very small doses is emphasized.

Irwin E. Gaynon.

Krimsky, E. Compensating convergence and accommodation device. *Trans. Amer. Acad. Ophth.*, 1947, March-April, pp. 307-308.

This instrument consists essentially of a movable test card for each eye and a movable electric target. These are attached to a horizontal beam which somewhat resembles a stereoscope and are mounted on a vertical base. (3 figures.)

Chas. A. Bahn.

Krimsky, E. Multiple target holder for visual field study. *Trans. Amer. Acad. Ophth.*, 1947, March-April, p. 306.

Eight possible target combinations are mounted on a black, long wooden holder. (1 figure.)

Chas. A. Bahn.

Modell, Walter. Pharmacologic action of some ophthalmic drugs. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 160-166.

The influence of surface tension, osmotic tension and pH on the absorp-

tion of drugs from solution by the conjunctiva is discussed. Recent evidence indicates that sulfonamide drugs are very effective when given systemically but that their local use is unsatisfactory. Penicillin is effective when used either locally, intramuscularly or orally. The oral administration is only about one-fifth as efficient as the intramuscular. There is a discussion of the choline drugs, mecholyl chloride, carbaminoylcholine chloride, and dibutoline.

John C. Long.

Ortin, Leoz. Ocular postoperative endogenous infection. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, Jan., pp. 33-47.

The author recommends the utmost care with patients who are to undergo ocular surgery, especially cataract extraction. If infection is suspected, the patients must be treated before, during, and after the operation. He emphasized the use of penicillin in large doses.

J. Wesley McKinney.

Pinticart de W., Elcira. Tuberculin therapy in Chile. *Bol. del Hosp. Oft. de Ntra. Sra. de la Luz*, 1946, July-Oct., pp. 207-215. Reproduced from *Rev. Brasileira de Oft.*, 1946, June, p. 303 (see *Amer. Jour. Ophth.*, 1946, v. 29, p. 1330).

Rodriguez Barrios R., Fuster, B., and Gherardi, J. Sulfamides and penicillin iontophoresis in ophthalmology. Clinical and experimental study. *Arch. Urug. de med., cir., y. especialid.*, 1946, v. 29, Oct., pp. 345-360.

The concentration of sulfamides and penicillin in the anterior chamber are much greater when administered by iontophoresis than by other methods. A mixture of penicillin and sulfamides is advocated when the etiologic factor is

unknown. This method fails in drug-resisting diseases and pathology caused by toxic or allergic ocular lesions.

Irwin E. Gaynor.

Thorpe, H. E. New forceps for the removal of nonmagnetic foreign bodies from the vitreous. *Trans. Amer. Acad. Ophth.*, 1947, March-April, p. 295.

One model which is designed for scleral incisions of four or more millimeters consists of a right angled cup-like jaw regulated by thumb pressure through a 10-cm. tube. The other model is for use with smaller incisions such as a two-millimeter trephine opening. Lateral grasping cups and a notched thumb release are employed. (4 figures.)

Chas. A. Bahn.

Wiener, Meyer. Applied anatomy in eye surgery. *Surg., Gynec. and Obst.*, 1947, v. 84, April 15, pp. 777-786.

Important surgical anatomical facts are stressed. The thin lid skin and atrophy of its elastic fibers in old age, the looseness of the conjunctiva and the greater space on the temporal side of the globe than the nasal are discussed. The best methods for producing local anesthesia are reviewed. The bluish appearance is a guide in splitting the cornea. The thinnest portion of the cornea is at its center while the sclera is thinnest just posterior to the muscle insertions. The emissary vessels and nerves are often injured during surgery. In clean enucleations the muscle tendons need not be sewn since they fall together naturally. In orbital cellulitis an enucleation may lead to meningitis, since Tenon's capsule is continuous with the dura. The muscles vary in size, width and site of insertion. The anterior hyaloid stretches and comes forward to simulate vitreous. When cutting the iris it is well to re-

member that the vessels run parallel with the radiations. In a discussion of surgery in congenital glaucoma removal of the fetal meshwork from the angle is recommended.

H. C. Weinberg.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Braun-Vallon, S., and Hartman, E. Aniseiconia. *Ann. d'Ocul.*, 1947, v. 180, Feb., pp. 65-75.

Inequalities in the size and shape of the two retinal images may be associated with the usual ametropic and heterophoric symptoms especially in psychoneurotic patients. The symptoms result from the fatigue involved in the more or less continuous effort to maintain binocular single vision. Usually the dominant eye, being less ametropic, has the smaller retinal image. Artificial aniseiconia may be produced by optically incorrect lenses especially if strong and decentered. Although few persons have retinal images which are exactly similar in size and shape, those in whom differences are less than one percent are usually free from symptoms and those who have differences of more than 1.75 percent usually have symptoms.

The ophthalmo-eikonometer and the space eikonometer are described. A French instrument somewhat similar to the latter, the logoscope, has been constructed by Grammont. The optical treatment of aniseiconia is designed to magnify the size of the smaller retinal image by the use of a thickened lens with or without changes of the curvatures used in the correction of the ametropia. Superimposed eisoconic lenses are heavy and usually impractical.

In a study of several groups treated

with eisoonic glasses the percentage of patients reported cured or greatly improved ranged from 20 to 50; of less improved from 12 to 60 and of unimproved from 25 to 30. Separating the psychoneurotic from the structural factors in the study of the eisoonic patient is not simple. (26 references.)

Chas. A. Bahn.

Briggs, A. H. Contact lenses in excelsis. *Brit. Jour. Ophth.*, 1947, v. 31, May, pp. 304-306.

This article is the account of a young pilot of the R.A.F. who had been refused pilot training because of compound myopic astigmatism of nine and six diopters. After he was fitted with contact lenses he reapplied and was accepted. The contact lenses had not been discovered. He received pilot training in England, Canada, and America, and passed numerous comprehensive medical examinations with his lenses undetected. During one of numerous missions over Germany, he was shot down. He escaped to England after many weeks wearing his lenses all the while. More rigid medical examinations and more flying followed. At the end of the war he was a test pilot and his contact lenses were still a secret. He usually wore the lenses routinely 17 to 18 hours daily and on two occasions as long as 30 to 36 hours without removing them.

The author makes a plea for more widespread use of contact lenses and also for more rigid ocular inspection during examinations which are believed to be of great importance.

Morris Kaplan.

Campbell, Dorothy. Binocular vision. *Brit. Jour. Ophth.*, 1947, v. 31, June, pp. 321-335.

The author presents a consideration of the physiological factors for the

maintenance of binocular vision. Important are the overlap in visual fields, strongly developed sense of fusion and dominance of macular over peripheral vision. In comparative studies it was found that convergence is present only in animals that possess maculas, and that body position is judged by the enervation given to ocular muscles. The localization of an image is not a purely sensory process, but a sensory-motor response, and fusion also requires a sensory-motor balance. In certain pathological conditions there is a surprising maintenance of binocular vision. It is recommended that training be started early. The use of atropine in the good eye in infancy to develop fixation in the squinting eye is advised.

O. H. Ellis.

Crisp, W. H. The study of refraction according to the technique employed by some North-American ophthalmologists. *Bol. del Hosp. Oft. de Ntra. Sra. de la Luz*, 1946, Nov.-Dec., and 1947, Jan.-Feb., pp. 217-236.

The author traces briefly the history of the technique of diagnosis of astigmatic amount and axis. He insists on the importance of preliminary diagnosis of hyperopia by adequate use of the fogging method (known in Spanish as "miopia artificial"). He also describes and illustrates his personal arrangement for mounting test charts, including a rotating cross, with a system of pulleys so that they may be moved easily from the examiner's position by the patient. It should be noted that figure 13, relating to this arrangement, has been rotated ninety degrees from its proper position. (14 figures.)

W. H. Crisp.

Fabre, P. Subjective method of measuring ametropia, without test-type or

lenses, by means of the variable bayonet. *Arch. d'Opht.*, 1946, v. 6, no. 4, pp. 436-447.

The author bases his method of measuring refraction on the original observations of Christophe Scheiner in 1619. His description of the method, which is technically complex, does not lend itself to abstraction. The author claims the method to be rapid and precise in patients having good visual acuity and normal mentality.

Phillips Thygeson.

Gaus, J. Eccentric binocular depth perception. *Ophthalmologica*, 1946, v. 112, Oct.-Nov., pp. 267-287.

The object of this study was to determine the acuity of binocular depth perception of eccentric retinal areas, a subject which, in contradistinction to the central acuity of stereoscopic vision, had received very little attention. The author used the method of Monjé (*Zeitschr. f. Sinnesphys.*, v. 69, p. 73 and 261) which is based upon the characteristic ability of man to recognize and to interpret in terms of depth a state of horizontal disparity of the retinal images and the characteristic inability to interpret in terms of depth a state of vertical disparity of the retinal images. A normally coordinated pair of human eyes is capable of recognizing very slight depth differences between two or three vertical rods but fails to recognize by binocular clues even very gross depth differences if the rods are placed horizontally (assuming that the observer's eyes are in primary position). Monjé's method utilizes this principle. A set of three black threads in which the center thread has been placed a certain distance forward or backward with reference to the other two threads, is first shown to the examinee in the horizontal position, that

is with the threads running parallel to the interpupillary line. In this position the existing disparity remains unnoticed if monocular clues (specifically head movements) are not permitted to come into play. Now the set of threads is rotated (toward the vertical position) until the examinee begins to perceive the greater or lesser depth of the center thread. The angle of rotation at which this sensation occurs is a measure of (inversely proportional to) the acuity of binocular depth perception. The method has been used extensively for determinations of the central (foveal) acuity of binocular depth perception. The author of the paper under review has modified the method by adding a fixation target 5 or 7 degrees away from the center of the center thread. Under these experimental conditions, keen observers are able to make consistent statements as to the position (degree of rotation) of the threads at which they first became aware of a depth difference between the three threads. The author found that eccentric retinal areas are definitely endowed with the power to recognize and interpret horizontal disparity. The upper paracentral portions of the retina proved to possess greater acuity of binocular depth perception than the lower retinal portions. The curves connecting retinal points endowed with equal acuity of binocular depth perception are very similar in shape to the isopters and to the curves connecting retinal points with equal visual acuity. Prolonged observation of the target causes a temporary drop in acuity.

P. C. Kronfeld.

Iribas, Gregorio. Oblique astigmatism of perpendicular axes. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, June, pp. 558-561.

The author has found that ten per cent of the patients with astigmatism have oblique astigmatism of which the position of the axis in one eye is perpendicular to that of the other. This kind of astigmatism is always less than one diopter, is well corrected in nine-tenths of the patients, and is symmetrical in respect to the vertical axis.

J. Wesley McKinney.

Koch, Walter. An improved dark adaptometer. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 235-237.

A redesigned and improved dark-adaptometer is presented. Filters of different colors as well as neutral filters for altering the intensity of light can be brought into position. The instrument allows for a wide range of readings on patients with gross disturbances of dark adaptation.

O. H. Ellis.

Maggiore, L. Skiascopic refractometer for the objective examination of the total refraction of the eye in its various meridians. *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 72, June, pp. 376-381.

Maggiore presents a picture, a diagram, a description, and directions for use, of an instrument designed to facilitate retinoscopy. It consists essentially of an adjustable mounting that embodies a retinoscope, a light source, and a battery of lenses. There are also chin- and browrests. The working distance is allowed for in the calibration of the scale and the refractive error in the various meridians may be read directly.

Harry K. Messenger.

Matteucci, P. The foveal adaptometer. *Rassegna. Ital. d'Ottal.*, 1943, v. 12, nos. 1-2, Jan.-Feb., p. 81.

Matteucci describes in detail a method of application of the adaptometer of Birch-Hirschfeld for the measure-

ment of the adaptation of the foveal and parafoveal regions of the retina. The retinal surfaces excited by a single luminous source in central fixation were 0.26 mm. in diameter at an angle of 1 degree, and 0.49 mm. at an angle of 2 degrees. This corresponds to a zone provided only with cones and another where these are mixed with rods. The author demonstrated that only by strict fixation limited to the fovea and with good control of fixation is it possible to study the adaptation of the rod-free area.

Eugene M. Blake.

Miles, P. W. Factors in the diagnosis of aniseikonia and paired Maddox-rod tests. *Amer. Jour. Ophth.*, 1947, v. 30, July, pp. 885-897. (2 figures, 1 table, 13 references.)

Neubert, Frank R. Color vision in the consulting room. *Brit. Jour. Ophth.*, 1947, v. 31, May, pp. 275-288.

Of 43,395 subjects who were examined for color vision 40,380 were males and 3,015 were females. Of this latter group only two were found to have defective color vision. This report deals with the males only. The 40,380 men were asked to read the original Ishihara Color Plates. Those who made a mistake (there were 2,235) were investigated by other means. They were next tested on the aviation model color lantern. Of 431 found unsafe with the plates, only 296 were found unsafe with the lantern. This proved that the plates were much more sensitive than the lantern. With the American Optical Company pseudo-isochromatic plates an even greater discrepancy resulted and a British reprint of the Ishihara plates proved entirely unsatisfactory.

A series of experimental lanterns was evolved in order to determine the influence of the size of the aperture, the

number of apertures, intensity of light and arrangement of colors. A triple apertured lantern using 10-mm. apertures with controlled illumination is the most sensitive and reliable apparatus for demonstrating defects of the color sense. Morris Kaplan.

Pérez Toril, F. Study of the causes of myopia. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, June, pp. 562-575.

A detailed study was made of 1,800 school children between 6 and 13 years of age in order to investigate the cause of myopia. The author concludes that the one and only cause of myopia is heredity. It can manifest itself or remain latent as it is governed by the laws of heredity. Prolonged close work with bad illumination can only accelerate the progress of the myopia until it reaches the point that it would have reached without any of these causes. J. Wesley McKinney.

Pignatosa, G. The accommodative power in subjects that have had iridocyclitis. *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 72, June, pp. 321-335.

From a study of eleven subjects (carefully selected so as to exclude all factors that might prejudice the results) Pignatosa concludes that iridocyclitis leads to a diminution of accommodative power. In seven cases of healed unilateral iridocyclitis there was a diminution of 0.50 to 2.00 diopters with respect to the sound eye, and in four cases of healed bilateral iridocyclitis a diminution of 0.25 to 3.00 diopters with respect to the mean values given in Duane's graph. It was observed that the accommodation fatigues more quickly in eyes that have suffered from iridocyclitis. Lens, ciliary muscle, and zonule are all factors in accommodation, but it was not determined which

of these is mainly responsible for the diminution. Harry K. Messenger.

Sloan, Louise L. Rate of dark adaptation and regional threshold gradient of the dark-adapted eye: physiologic and clinical studies. *Amer. Jour. Ophth.*, 1947, v. 30, June, pp. 705-720. (2 tables, 20 figures, 22 references.)

4

OCULAR MOVEMENTS

Agnello, F. Clinical symptomatology and diagnostic criterions of paralyzes of some cranial nerves consecutive to fracture of the base. *Riv. Oto-Neuro-Oft.*, 1946, v. 21, May-Aug., pp. 183-198.

Four cases of oculomotor paralyzes due to fracture of the base of the skull are reported. The clinical symptomatology and the diagnostic signs for the localization of the seat of fracture are described. The paralysis may manifest itself soon after the trauma: this happens in lesions of the base with interruption of the continuity of the nerve at the seat of the fracture or compression of the nerve by hemorrhage. In other cases the paralysis appears some time after the trauma, probably as a result of neuritis. The origin of this neuritis is discussed. (4 figures, bibliography.)

Melchior Lombardo.

Arruga, H. Simple tenotomy. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, Jan., pp. 17-22.

The author gives a simple operative technique for correcting squint that consists of tenotomy with retention of the tendon by means of a thread, which is easy to place and to remove. He performs a recession that never exceeds 7 mm. on the internal rectus or 12 mm. on the external rectus. (10 illustrations.) J. Wesley McKinney.

Cattaneo, Donato. An unusual case of a foreign body in the orbit. *Ann. di Ottal. e Clin. Ocul.*, 1946, v. 72, May, pp. 257-260. (See Section 13, Eyeball and orbit.)

Cristini, Guiseppe. Isolated trochlear nerve paralysis following indirect cranial trauma. *Riv. Oto-Neuro-Oft.*, 1943, v. 20, July-Aug., pp. 240-247.

A 63-year-old woman, hit by a bicycle at high speed, suffered a retrograde amnesia when she regained consciousness after 48 hours and showed an isolated unilateral paralysis of the right fourth nerve. The vulnerability of this nerve in cranial trauma is explained by its long course through the cranial cavity. In this patient there was a fracture of the skull through the inner portion of the sphenoidal fissure where the fourth nerve is adjacent to the cranial wall. (Bibliography.) K. W. Ascher.

Gibson, G. G. Marginal myotomy. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 175-181.

The author describes his technique for marginal myotomy. This operation differs from a partial tenotomy in that it is performed posterior to the tendon, in the muscle, and consequently produces a much greater effect. Two incisions are placed in the margins of the muscle directly opposite each other, leaving a central band of intact muscle 2 to 3 mm. wide. The results of 22 cases in which this procedure was used on the external rectus are analyzed. The most suitable cases are those in which the strabismus is of short duration and the amount not too great and those in which the strabismus is of the early alternating and symmetric type.

John C. Long.

Healy, Electra. Divergence excess:

an anomaly of the extrapyramidal system. *Amer. Jour. Ophth.*, 1947, v. 30, June, pp. 753-754.

Irvine, G. A Survey of esophoria and ciliary spasm. *Brit. Jour. Ophth.*, 1947, v. 31, May, pp. 289-304.

Ciliary spasm and pseudomyopia are intimately associated with emotional turbulence and the post-war period has produced an increasing number of patients with this manifestation. The author briefly reviews the clinical records of several patients with various types of esophoria who were benefited considerably or cured completely by orthoptic exercises. The esophoria was associated with normal divergence, with divergence weakness, and with old accommodative squint.

Ciliary spasm was found to be monocular or binocular and occurred with exophoria or esophoria, without muscle imbalance and with pseudoesophoria. Most frequent symptoms of spasm were blurred distance vision, rapid lowering of visual acuity, pain in the eyeballs, frontal headaches, and tensing of ocular muscles. These manifestations often are symptoms of true myopia but in spasm the measurements seem to vary from day to day. Treatment consisted of attempts to relieve or cure the precipitating emotional disturbance, the application of atropine twice daily and frequent orthoptic exercises. Results of therapy were generally good although relapses were not uncommon.

Morris Kaplan.

Jedlowski, Paolo. Chronic progressive ophthalmoplegia externa nuclearis. *Riv. Oto-Neuro-Oft.*, 1943, v. 20, July-Aug., pp. 203-239.

A formerly healthy woman developed unilateral blepharoptosis at the age of 19 years. Five years later other

external ocular muscles became involved and when the patient was 25 years old, she had a complete nonfamilial, chronic, progressive external nuclear ophthalmoplegia. She never had any other neurologic or psychic disease and died of pneumonia at the age of 25 years. Examination of her central nervous system (thirty photomicrographs) revealed severe cellular changes in the nuclei of the third, fourth, and sixth nerves; no changes were found in the nuclei of Edinger-Westphal and of Perlia. This case and that published by Langdon and Cadwalader in 1928 are the only ones in the literature with both clinical and histopathologic study. (Extensive bibliography.) K. W. Ascher.

Roth, Edith. Which squints respond best to orthoptic treatment. *Amer. Jour. Ophth.*, 1947, v. 30, June, pp. 748-751. (Discussion.)

Sandifer, P. H. Chronic progressive ophthalmoplegia of myopathic origin. *J. Neurol., Neurosurg. and Psychiat.*, 1946, v. 9, July, pp. 81-83.

Chronic progressive ophthalmoplegia signifies a syndrome characterized by a slowly progressive weakness of the external ocular muscles. The term has been applied to cases of slowly increasing oculomotor palsy presumably due to degeneration of the cells of the third, fourth, and sixth cranial nerve nuclei. While the few published accounts of cases show that degeneration of the oculomotor nuclei has occurred, it has been impossible to determine whether the degeneration has been primary or secondary to some other disease process.

The case of a man, 29 years of age, is presented. He was admitted to the hospital because of a pulse rate of 30 per minute after a slight air-raid injury.

He had drooped eyelids and had had trouble in moving his eyes for many years. Although told that the drooping had existed since he was 14 years of age, he, himself, had not noticed it until he was 20. The eyes were becoming increasingly more immobile.

There was gross bilateral ptosis with compensatory contraction of the frontalis muscles. The eyeballs were almost completely fixed. There was no internal ophthalmoplegia. The movements were not improved by prostigmine. Myotonia was absent, hair distribution and testes were normal, and the Wassermann reaction was negative.

Portions of the external recti were removed for histologic study and surgery for ptosis was performed. Studies of the tissue showed that the ophthalmoplegia was of myopathic origin. This method is considered of value as an aid in the diagnosis and classification of this type of disease.

Francis M. Crage.

Swan, K. C. A squint syndrome. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 149-154.

The author describes seven cases of a squint syndrome in which the squinting eye is so deviated that its physiologic blind spot plays a special role as a central scotoma. The history is that of a mild degree of convergent strabismus with periodic diplopia. The syndrome consists of hypermetropia or anisometropia, esotropia of 12 to 17 degrees for distance fixation, normal retinal correspondence and a binocular visual field in which the physiologic blind spot of the squinting eye constantly overlies the point of fixation. Fusional ability, with a limited amplitude of convergence and divergence, can be demonstrated by haploscopic devices adjusted to the deviation of the eyes.

The prognosis for restoration of comfortable single binocular vision is excellent if this "blindspot syndrome" is recognized and treatment is properly directed. In addition to glasses and surgical measures, orthoptic training must be utilized to develop an adequate amplitude of fusional movements and to establish a proper convergence-accommodation mechanism.

John C. Long.

Wheeler, Maynard. The management of strabismus in children. *Surg., Gynec. and Obst.*, 1947, v. 84, April 15, pp. 787-791.

The author stresses the importance of obtaining an early accurate vision. If the squint is firmly monocular, the squinting eye is amblyopic. If there is alternation even in only one field, one can assume approximately equal vision. The Hirschberg corneal reflex test, White's cover test, and the prism reflex tests are discussed. Treatment should be given as early as possible with glasses or surgery to avoid secondary muscle changes and to obtain binocular vision. Accommodative squints do not often appear before two years of age. Orthoptic exercise is desirable. Only if there is a hyperopia of four diopters or more and the squint is eliminated with glasses should operation be postponed indefinitely. Some general principles in muscle surgery are offered.

H. C. Weinberg.

5

CONJUNCTIVA

Dwyer, J. M. Solar photophthalmia. *M. J. Australia*, 1947, April 26, pp. 523-525.

Solar ophthalmia which occurred among convoy drivers during the summer months in the Northern Territory

of Australia was relieved by painting a green strip two inches wide across the top of the windshield. This restricted vision to land surface only and eliminated all view of the sky.

Irwin E. Gaynon.

Marin Amat, M. Cyst developed within a pterygium. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, June, pp. 550-552.

A man, 32 years of age, had a pterygium and a small cyst in it. The pterygium and cyst were removed.

J. Wesley McKinney.

Patz-Arnall. An eruptive fever involving the skin and mucous membranes (Stevens-Johnson disease). *New England J. Med.*, 1947, v. 236, May 8, pp. 697-700.

An eight-year-old boy had an upper respiratory infection with fever, tearing, photophobia and sore throat. The next day blisters developed on the upper lip, forearm and abdomen and on the third day an acute keratoconjunctivitis followed. A balanitis developed subsequently. A pseudodiphtheritic membrane covered the cornea and sclera. During the second week the membrane sloughed away and left ulcers that healed with opacification and symblepharon. The final visual acuity was 20/60 in each eye.

Irwin E. Gaynon.

Romero, Eduardo. Operative procedure in the treatment of posterior symblepharon. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Nov., pp. 1161-1162.

An easy technique for the treatment of posterior symblepharon is given. One goes through the adhesion from side to side with a needle carrying several threads. Later, when the tunnel is well epithelialized, the bridge is cut as in an

anterior symblepharon. Three cases are reported. J. Wesley McKinney.

Rostkowski, L. The operations of Hotz-Anagnastakis, of Denig, and of canthoplasty as performed in the anti-trachoma teaching organization. *Arch. d'Ophth.*, 1946, v. 6, no. 4, pp. 456-459.

The author reports observations on the efficacy of various trachoma operations. The most commonly employed operation was that of Hotz-Anagnastakis for cicatricial entropion which was used in 1,138 cases. The technique of the operation is described in detail and a modification to increase its effectiveness is reported. A canthoplasty was almost invariably performed at the same time. Of 121 patients which were followed for from one to five years after the operation, good functional results were obtained in 91, satisfactory results in 16, insufficient results in 12, and unfavorable results in 2. Good cosmetic results were obtained in 63, satisfactory cosmetic results in 49, and unfavorable cosmetic results in 9.

There were 230 operations performed for relief of advanced pannus according to the method of Denig. The author describes Denig's technique for the operation as well as his own modification. The mucous membrane grafts invariably survived. Of 85 patients observed for a year or more after operation a good cosmetic result was obtained in 78 and a poor result in 7. In five of the latter the graft appeared as a conspicuous red tumor. The effect on the pannus was considered favorable in 56 patients, in 18 the results were questionable, and in 11 unsatisfactory. Sixty-nine of the patients stated that they believed that the operation had improved their vision whereas 13 claimed no improvement. In a second series of 28 patients followed for a

year or more but in which the follow-ups were not made by the author personally, there were 26 with good cosmetic results and two with unsatisfactory cosmetic results. Twenty of the 26 claimed improvement in vision.

The author concludes that the operations described have proved satisfactory. Phillips Thygeson.

Selfa, Enrique. Irradiation of the thymus in the treatment of vernal catarrh. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, Feb., pp. 175-177.

Two patients with vernal catarrh, resistant to the usual forms of therapy, were promptly relieved of their subjective symptoms by irradiation of the thymus. Ray K. Daily.

Stern, H. J. Conjunctivitis due to exposure to dimethyl-sulfate. *Brit. Jour. Ophth.*, 1947, v. 31, June, pp. 373-375.

A detailed case report of a worker who developed a severe bilateral conjunctivitis in the palpebral fissures due to exposure to dimethyl-sulfate is presented. The condition permanently cleared after change of occupation. It was noted that not all workers were similarly affected. The literature is discussed. O. H. Ellis.

6

CORNEA AND SCLERA

Benner, R. Is filamentary keratitis infectious? *Ann. d'Ocul.*, 1947, v. 180, March, pp. 140-141.

Infection may play a more or less important role in the causation of this condition. Two cases are described in which filamentary keratitis quickly subsided after the use of penicillin ointment. Chas. A. Bahn.

Borsello, G. Familial degeneration of

the cornea. *Rassegna Ital. d'Ottal.*, 1943, v. 12, March-April, pp. 143-163.

Four cases of corneal dystrophy in two families are reported. All were of the nodular type, bilateral and of various forms—grayish-white spots, rings, and dots, all limited to the central and paracentral zone. In two of the patients the lesions were seated in the periphery of Bowman's membrane, and in the other two in the superficial layers of the parenchyma. All of the patients had a slight increase of blood calcium.

The author believes the cause to be a nutritional disturbance producing functional modification of the trophic nerves, central or peripheral. These changes are hereditary and probably result, directly or indirectly, from a general disfunction of the organs of internal secretion. (4 figures.)

Eugene M. Blake.

Colombo, G. The pathogenesis of band-like opacity of the cornea. *Rassegna Ital. d'Ottal.*, 1943, v. 12, nos. 1-2, Jan.-Feb., p. 31.

A 51-year-old man was seen after two years of trouble with both eyes. Examination disclosed a typical band-like opacity of the cornea, associated with bilateral cornea guttata. The writer agrees with the explanation of Schick that the band-like opacity results from an alteration of the cornea-aqueous barrier arising in the endothelium of Descemet's membrane. The true corneal changes develop later from this source. The cornea guttata is probably a senile or presenile dystrophy and has been previously described in association with band-like opacity. (2 figures.)

Eugene M. Blake.

Di Fernando, R. Osseous fragility and blue sclerotics. *Rassegna Ital. d'Ottal.*, 1943, v. 12, May-June, p. 196.

The principal and secondary signs of the syndrome are presented. A patient, 29 years of age, had all the manifestations of this syndrome except the auditory changes. The study of the genealogical tree shows various members with the characteristic scleral color, some with and some without the osseous alterations. Only the father of the patient had all the signs of the complete syndrome. The modification of manifestation at different ages suggests the probable intervention of endocrine factors. (6 figures.) E. M. Blake.

Favaloro, G. Endotheliazation of the anterior chamber and secondary keratitis. *Rassegna Ital. d'Ottal.*, 1943, v. 12, Jan.-Feb., p. 3.

Favaloro describes a pathologic condition which consists of changes in the structures of the anterior segment of the globe. These he divides into three phases, the first of which is a primary alteration of Descemet's membrane and endothelium with a subacute inflammatory reaction in the iris. In the second phase there is a secondary participation of the corneal parenchyma and the epithelium. In the third place corneal opacities, more or less extensive and dense, appear principally in the anterior layers of the cornea and the epithelium.

The disease lasts for weeks or months and the lesion is mostly located in the central and paracentral region and is similar to other forms of keratitis profunda. The author proposes the name endothelio-irido-descemetitis and believes it to be a distinct entity. (5 figures.)

Eugene M. Blake.

McNicholas, P. J. Phlyctenular keratoconjunctivitis as observed in Normandy. *Ann. d'Ocul.*, 1946, v. 179, Dec., pp. 619-623.

Thirty-two cases of phlyctenular ker-

atoconjunctivitis were observed in a study of 924 tuberculin-sensitive persons made during the early part of 1946. Normandy was one of the most heavily devastated areas in France during the war and hygienic and dietetic conditions were extremely poor. In 18 of the patients with ocular disease a primary thoracic infection was observed radiographically.

Chas. A. Bahn.

Soria. *Leishmania* interstitial keratitis. Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, June, pp. 544-549.

A young man had acne on his face for three years before developing an ocular complaint. *Leishmania tropica* was found in one of the lesions. In his left eye he had pericorneal injection, photophobia, epiphora, and interstitial keratitis without corneal ulcer. The right eye was normal. All laboratory tests were negative. The anti-leishmania treatment was effective in healing the skin lesions and ocular disturbances. The keratitis left a faint corneal opacity.

J. Wesley McKinney.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Corcelle, L. On meningeal reactions in sympathetic ophthalmitis. Brit. Jour. Ophth., 1947, v. 31, June, pp. 366-372.

The author discusses the literature and presents three cases of sympathetic ophthalmitis with meningeal reaction. Examination of cerebrospinal fluid showed lymphocytic meningitis which varied in intensity with the severity of the ocular disease. In severe ocular inflammations there was a more marked meningeal reaction, but the prognosis could not be correlated with

the reaction. This possible path of transmission of a filterable virus of unknown origin suggests that sympathetic ophthalmitis may be a lymphocytic uveomeningitis. O. H. Ellis.

Crespi, G. Persistent hemorrhages in the anterior chamber. Arch. de la Soc. Oft. Hisp.-Amer., 1947, v. 7, Jan., pp. 23-32.

Four cases of persistent hyphema with a lesion of the iris with or without surgical procedure are reported. In one, the hemorrhage was associated with a chronic, probably tuberculous, iridocyclitis. An iridectomy had been performed a year before. In a second patient postoperative hyphema increased with cyclodiathermy when this procedure produced a low ocular tension in an eye with hypertension due to an old pupillary seclusion and a degenerate iris. In a third eye with chronic syphilitic iritis hypertension was relieved by means of miotics. Slight hyphema appeared at the level of the synechia. In a fourth eye there was persistent hemorrhage after a surgical procedure with a lesion of the iris. In all cases degenerative lesions of the iris were found. (Several illustrations.)

J. Wesley McKinney.

Peris, E. Fornes. A histopathologic report of a case of choroideremia. Arch. de la Soc. Oft. Hisp.-Amer., 1947, v. 7, Feb., pp. 134-138.

The eyes of an infant that had died of malnutrition, were enucleated post-mortem, for the study of the lagophthalmic corneal ulcers. Microscopic examination of the eyes revealed total absence of the choroid. The microscopic appearance is described and illustrated with six photomicrographs. The etiology of this rare anomaly is discussed.

Ray K. Daily.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
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News items should reach the editor by the 12th of the month.

DEATHS

Dr. Warren Beagle Davis, Philadelphia, Pennsylvania, died July 7, 1947, aged 65 years.

Dr. Charles John Edwards, Vicksburg, Mississippi, died March 13, 1947, aged 62 years.

Dr. Delbert Oscar Kearby, Indianapolis, Indiana, died April 10, 1947, aged 68 years.

Dr. Charles Alford Maghy, San Diego, California, died April 27, 1947, aged 62 years.

Dr. William Robert Thompson, Fort Worth, Texas, died May 1, 1947, aged 84 years.

Dr. Arthur Morris Zinkhan, Washington, D.C., died April 30, 1947, aged 56 years.

ANNOUNCEMENTS

20TH GRADUATE FORTNIGHT

The New York Academy of Medicine, 2 East 103 Street, New York 29, announces the 20th Graduate Fortnight from October 6 to 17, 1947. This year the Graduate Fortnight will be devoted to the study of Disorders of Metabolism and the Endocrine Glands. The program includes—morning panel discussions, afternoon clinics, evening lectures, scientific exhibits and demonstrations. The registration fee is five dollars. A program will be mailed to every Fellow of the Academy without request and to other physicians upon request. Address request to Dr. Mahlon Ashford, 2 East 103 Street, New York 29, New York.

Evening Lectures

OCTOBER 6—Opening Address—George Baehr, *President, The New York Academy of Medicine. The Ludwig Kast Lecture—The Diseases of Adaptation, With Main Emphasis Upon Hypertension*—Hans Selye, *Institute of Experimental Medicine and Surgery, University of Montreal*

The Carpenter Lecture—Adaptation Syndrome In Man—John S. L. Browne, *McGill University Clinic of the Royal Victoria Hospital, Montreal*

OCTOBER 7—Energy Metabolism In Obese Persons—Louis H. Newburgh, *University of Michigan Medical School*

Psychological Aspects of Obesity—Hilde Bruch, *College of Physicians and Surgeons, Columbia University*

OCTOBER 8—Relation Of The Adrenals To Immunity—Abraham White, *Yale University Clinical and Experimental Studies On Adrenal Cortical Hyperfunction*—Louis J. Soffer, *Mount Sinai Hospital*

OCTOBER 9—Metabolic Consequences of Im-

mobilization—John E. Deitrick, *Cornell University Medical College*

Use of Androgens In Women—Ephraim Shorr, *Cornell University Medical College*

OCTOBER 10—Studies In Intermediary Metabolism Conducted with the Aid of Isotopic Tracers—DeWitt Stetten, Jr., *Harvard University Medical School*

The Excretion of Urinary Steroids In Health and In Disease—Konrad Dobriner, *Sloan-Kettering Institute for Cancer Research*

OCTOBER 13—Disturbances In Electrolyte Metabolism In Man and Their Management—Daniel C. Darrow, *Yale University School of Medicine*

Role of Amino Acids In Nutrition—William C. Rose, *University of Illinois*

OCTOBER 14—Metabolic Functions In Old Age—Nathan Shock, *U. S. Public Health Service, Baltimore City Hospital*

General Aspects of Cushing's Syndrome—E. C. Reifenstein, Jr., *Sloan-Kettering Institute for Cancer Research of the Memorial Hospital Cancer Center*

OCTOBER 15—Hormonal and Chemical Factors Regulating Thyroid Function—Rulon W. Rawson, *Harvard University Medical School*
Some Clinical Experiments With Antithyroid Compounds—Edwin B. Astwood, *Joseph H. Pratt Diagnostic Hospital, Boston*

OCTOBER 16—Testicular Dysfunction, Some Clinical Aspects—E. Perry McCullagh, *Cleveland Clinic, Cleveland*

Use of Androgens In Men—Carl G. Heller, *University of Oregon Medical School*

OCTOBER 17—Why Do Women Abort—Arthur T. Hertig, *Harvard University Medical School*
Morphological Basis for Menstrual Bleeding—Joseph E. Markee, *Duke University*

WILL LOAN SHERSHEVSKAYA'S BOOK

Transplantation of the Cornea Using Freshly Conserved and Fixated Material, by O. I. Shershevskaya, assistant in the Eye Clinic of the Institute of Post-Graduate Medical Study, Novosibirsk, U.S.S.R., 1940.

This book, which was presented in the form of a thesis for a degree of Medical Sciences by one of Dr. V. P. Filatov's former pupils, has been made available to ophthalmologists in English through a generous financial contribution from The Eye-Bank for Sight Restoration.

There are three typewritten copies available of some 233 pages. It has been divided into several parts: Historical, Surgical Technique, Experimental, and Some Observations on the

Results of the Operation on Human Subjects. Of greatest value and interest to ophthalmologists who are familiar with corneal transplantation is the chapter on the historical review.

These books will be loaned upon request, free of charge, to ophthalmologists who are interested. Address: The Eye-Bank for Sight Restoration, Inc., 210 East 64th Street, New York 21, New York.

REFRESHER COURSE REGISTRATION

The Chicago Ophthalmological Society will give a 40-hour refresher course December 8 to 13, 1947. The faculty will include members of the eye departments of The University of Chicago, The University of Illinois, Loyola University, and Northwestern University, and staff members of all of the principal hospitals of Chicago. Instruction will consist of didactic and practical courses, emphasis being placed on the practical courses given to small groups. Physicians practicing in the fields of ophthalmology and eye, ear, nose, and throat are eligible for the course. The fee will be \$100.00. For details write to the registrar, Miss Maude Fairbairn, 8 West Oak Street, Chicago, Illinois.

MISCELLANEOUS

STANFORD UNIVERSITY APPOINTMENTS

Dr. Hans Barkan, now clinical professor of ophthalmology and chief of the division of ophthalmology at Stanford University School of Medicine, became emeritus on September 1, 1947.

Dr. Alfred E. Maumenee, Wilmer Ophthalmological Institute, Baltimore, has been appointed professor of surgery assigned to ophthalmology to succeed Dr. Barkan. Dr. Maumenee will not assume his duties at Stanford University until September 1, 1948. In the meantime, Dr. Dohrmann Kaspar Pischel, clinical professor of ophthalmology at Stanford, will act as chief of the division until Dr. Maumenee can join the staff.

TEMPLE UNIVERSITY OPHTHALMOLOGY CHIEF

Dr. Glen G. Gibson, Philadelphia, has been appointed professor and head of the Department of Ophthalmology at the Temple University School of Medicine and Hospital, succeeding Dr. Walter I. Lillie, who died February 21st. Dr. Gibson, a graduate of St. Louis University School of Medicine, St. Louis, in 1930, has been an associate professor of Ophthalmology at Temple University School of Medicine. He interned at Providence Hospital, Detroit, and

was a fellow in Ophthalmology at the Mayo Clinic, Rochester, Minnesota, 1931-1934.

UNIVERSITY OF ILLINOIS APPOINTEE

Dr. William F. Hughes, Jr., associate professor of Ophthalmology, Indiana University School of Medicine, Bloomington-Indianapolis, has been made head of the Department of Ophthalmology at the University of Illinois College of Medicine. Dr. Hughes was graduated in medicine from Johns Hopkins University School of Medicine, Baltimore, in 1938, interned at Johns Hopkins Hospital and later served as assistant resident and resident ophthalmologist of the outpatient department. During the war he conducted research on treatment of chemical burns of the eye at Johns Hopkins University for the Office of Scientific Research and Development.

OHIO STATE APPOINTS CULLER

Appointment of Dr. Arthur M. Culler, a member of the Department of Ophthalmology staff at Ohio State University since January, 1946, as chairman of the department has been announced by President Howard L. Bevis.

Dr. Culler succeeds the late Dr. Albert D. Frost, who headed the department in the Ohio State University College of Medicine from 1929 until his death November 15, 1945. Dr. Claude S. Perry has been acting chairman and will now continue as an associate professor.

NEW ORLEANS EYE-BANK ORGANIZED

The newly organized Eye-Bank in New Orleans, Louisiana, will have the coöperation of the Louisiana State University Medical School and the Tulane University Medical School and Hospital. It is located in the Hutchinson Memorial Building, and Mrs. Orville Ewing is serving as executive director. The officers are Charles E. Fenner, president; Dr. William B. Clark, 1st vice president; George L. Hardin, 2d vice president; John F. Reilly, treasurer; and John W. Sims, secretary.

SOCIETIES

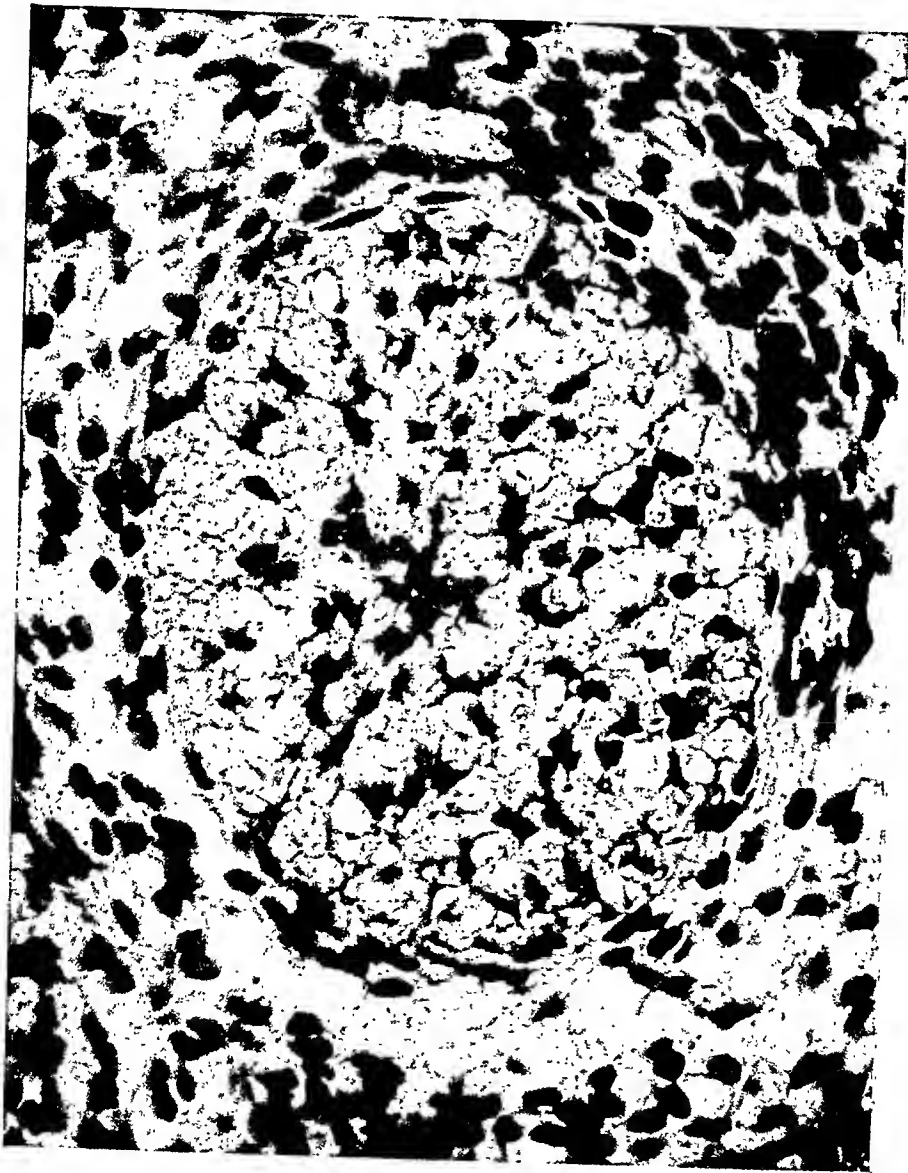
INSTITUTE PENIDO BURNIER OFFICERS

The Medical Association of the Instituto Penido Burnier has appointed the following officers for 1947-1948: President, Dr. João Lech, Jr.; 1st secretary, Dr. Guedes de Melo Fo.; 2nd secretary, Dr. Alberto Galo; librarian-treasurer, Dr. Leôncio de Suza Queiroz; editors of the *Arquivos de Instituto Penido Burnier*, Dr. Penido Burnier, Dr. Gabriel Pôrto, and Dr. F. J. Monteiro Sales.

or consult classified telephone directory

DIRECTORY

Winnipeg
RAMSAY, ROBERT S.



FRONTISPIECE (HADEN). CROSS SECTION OF OPTIC STALK SOON AFTER ENTRANCE OF
AXONS OF GANGLION CELLS OF RETINA.

THE DEVELOPMENT OF THE ECTODERMAL FRAME-
WORK OF THE OPTIC NERVE, WITH ESPECIAL
REFERENCE TO THE GLIAL LAMINA
CRIBROSA*HENRY C. HADEN, M.D.
Houston, Texas

When the optic stalk first appears, its wall is composed of undifferentiated epithelial cells (fig. 1) differing in no way from those of the optic vesicle and brain wall with which it is in continuity.

At about the 15-mm. age, the axons of the ganglion-cells of the retina grow back into the wall of the optic stalk on their way to the brain, which they reach at the 20-mm. age. The entrance of the axons, the optic-nerve fibers, into the stalk wall initiates a great change in the epithelial cells of the stalk wall. Their nuclei become somewhat oval, and the cell protoplasm vacuolated and partially absorbed. The result is an irregular arrangement of starlike cells with anastomosing processes through which the optic-nerve fibers pass (*frontispiece*). These are the glial cells which form the sustentacular tissue, framework, or septa of the optic nerve in young embryos.

At first the glial cells are scattered irregularly throughout the nerve, and the optic-nerve fibers passing among them are not in parallel rows. Later on the glial cells show a tendency to line up in longitudinal rows between the bundles of optic-nerve fibers to form the primary

septa. In longitudinal sections of a 20-mm. embryo (fig. 2) the early condition is apparent. The optic-nerve fibers are not in bundles but course irregularly throughout the nerve, and the glial cells have no definite pattern (fig. 2).

Cross section of the fellow nerve of the 20-mm. embryo made back of the globe, near the entrance of the hyaloid artery, shows this lack of design (fig. 3) but about the middle of the orbital part of the nerve (fig. 4) the glial cells congregate about its axis in a stellate arrangement. In the posterior third of the nerve (fig. 5) the residual lumen of the optic stalk is seen with glial cells surrounding it. The cells forming its lining have the appearance of the original epithelial cells. If the lumen of the stalk is followed back (fig. 6) it will be found to pass into the recessus opticus in the telencephalon. At the 29-mm. age (fig. 7) longitudinal sections show more regularity of arrangement but the optic-nerve fibers are not in bundles and the glial cells are not lined up in parallel rows to form septa. Cross section of the fellow nerve of the 29-mm. embryo (fig. 8) in the region of the anlage of choroid shows more definite design. The cell bodies are more regularly spaced and the anastomosing processes form a network through

*Read at the 82nd annual meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.

which the nerve fibers pass. The appearance is very much that of the definitive glial lamina cribrosa.

There is not much regularity of pattern of the nerve as a whole until the 45-mm. age is reached when some suggestion of rows of glial cells are seen (fig. 9). Also the peripheral glial mantle is well developed (fig. 9). It is recognized as a layer of cells continuous with the pigment layer of the retina. It leaves the pigment layer at almost a right angle and passes brainward, covering the outer surface of the optic nerve. As it is a continuation of the pigment layer of the retina, which is a modification of the original wall of the optic vesicle, the peripheral glial mantle must be composed of the original epithelial cells forming the outer surface of the stalk. Processes from it enter into the nerve but no mesodermal tissue other than that accompanying the hyaloid artery is found in the nerve at this age. At the end of the optic nerve adjacent to the vitreous there is a clumped mass of cells called "Bergmeister's Papilla" (fig. 9), the analogue of the pecten of birds. It is composed of original epithelial (ectodermal) cells which were isolated by the curving nerve fibers as they grew back from the inner wall of the optic cup into the stalk (fig. 9).

The nerve of the 67-mm. embryo (fig. 10) shows much more regularity of detail when seen in longitudinal section. The glial cells are lined up in parallel longitudinal rows between the bundles (fasciculi) of nerve fibers in the orbital portion. In the distal end of the nerve, that opposite the anlagen of the choroid and sclera, the arrangement is different. Here the glial cells lie in well-defined parallel rows with the long axes of their nuclei at right angles to the nerve fibers. These constitute the anlagen of the laminae cribrosae (fig. 10). Until the

67-mm. age, the optic nerve is composed of only ectodermal tissue with the exception of the mesoderm accompanying the hyaloid artery. At this age capillaries accompanied by fibroblasts grow into it from the anlage of the pial sheath. This is the first invasion of the mesoderm which is to grow along the columns of glial cells which form the primary septa of the nerve. From this age on the mesoderm grows into the nerve and follows the columns of glial cells as a grapevine climbs on an arbor. In this manner the mesoderm replaces most of the glial cells and forms the definitive fibrous connective-tissue septa of the optic nerve. However, there are always gaps in the mesodermal septa which are filled in by glial cells. By the 97-mm. age (fig. 11) there is much more mesoderm in the orbital portion of the nerve but there is none in the region opposite the choroid and sclera, the anlagen of the laminae cribrosae. Cross sections through this location show the glial cells and processes forming a network through which the nerve fibers pass. The appearance is very much as it was when the glial cells first formed.

At about 4½ months of age (fig. 12) a change takes place in the distal end of the nerve. Rows of glial cells from Bergmeister's Papilla grow out into the vitreous on either side of the hyaloid artery forming its glial sheath. There is a space between the sheath and the walls of the artery. This sheath disappears before birth. By the 360-mm. age (circa 7 months) many fibrous connective-tissue fibers have grown into the network of glial cells opposite the anterior third of the sclera to form the connective-tissue lamina cribrosa (lamina scleralis). They are a direct ingrowth from the sclera (or the border tissue, which is the same) and not a forward growth of the septa

of the orbital portion of the optic nerve. These mesodermal fibers increase in number until, at the 500-mm. age (fig. 13), they form the major portion of the scleral lamina cribrosa. The portion of the nerve anterior, or distal, to the lamina scleralis is not invaded by mesoderm at any time but remains ectodermal throughout life. Toward the end of fetal life, the nerve fibers in the orbital portion of the optic nerve are medulated, the medulation ceasing at the posterior, or brain side, of the lamina scleralis (connective-tissue lamina cribrosa). The nerve fibers anterior to the connective-tissue lamina cribrosa are naked axis cylinders. The glial cells and fibers that lie in front (fig. 14) of the lamina scleralis and opposite to the cho-

roid form the glial lamina cribrosa, which is also called lamina chorioidalis (fig. 14).

The glial lamina cribrosa occupies a unique position for it is the framework of the optic disc (fig. 15) and the ophthalmoscopic picture varies with its arrangement. Furthermore, it participates in all pathologic processes involving the intraocular end of the optic nerve and it must be destroyed before the typical glaucomatous cup can be produced.

1914 Travis Street.

The illustrations which follow were made from unretouched photographs of sections of human embryos and fetuses in my private collection.

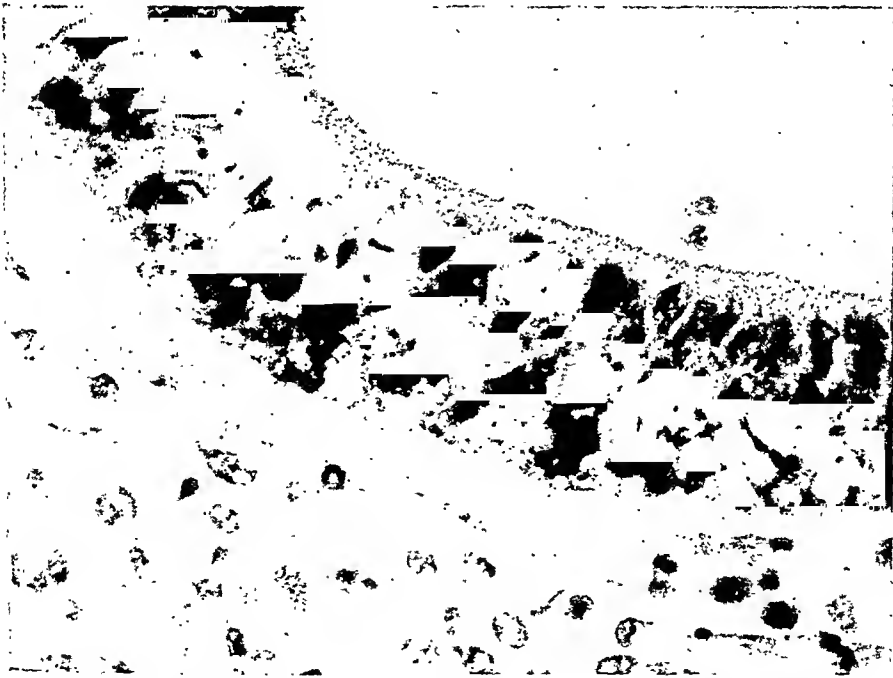


Fig. 1 (Haden). 4-mm. embryo, section of stalk wall, Undifferentiated epithelial cells.

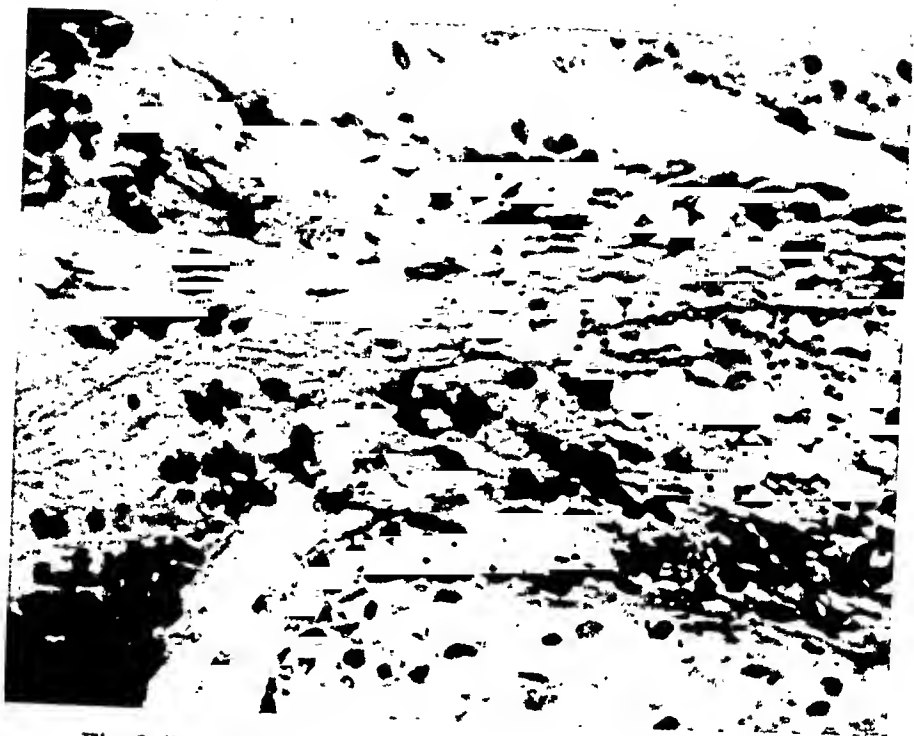


Fig. 2 (Haden). 20-mm. embryo, longitudinal section optic nerve.

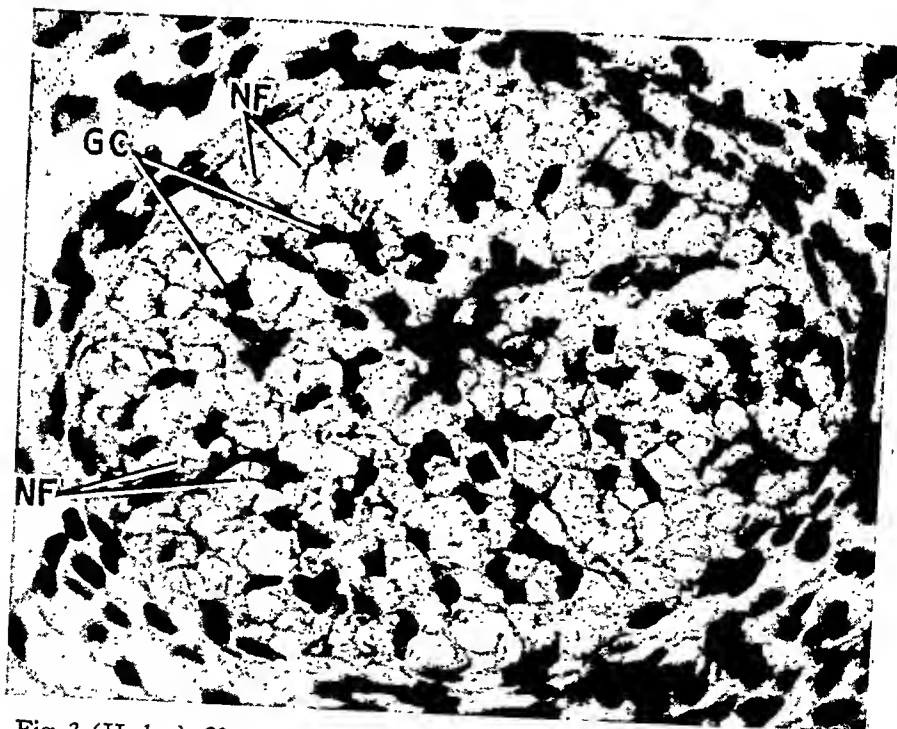


Fig. 3 (Haden). 20-mm. embryo, cross section of optic nerve. GC, glial cells with anastomosing processes; NF, nerve fibers.

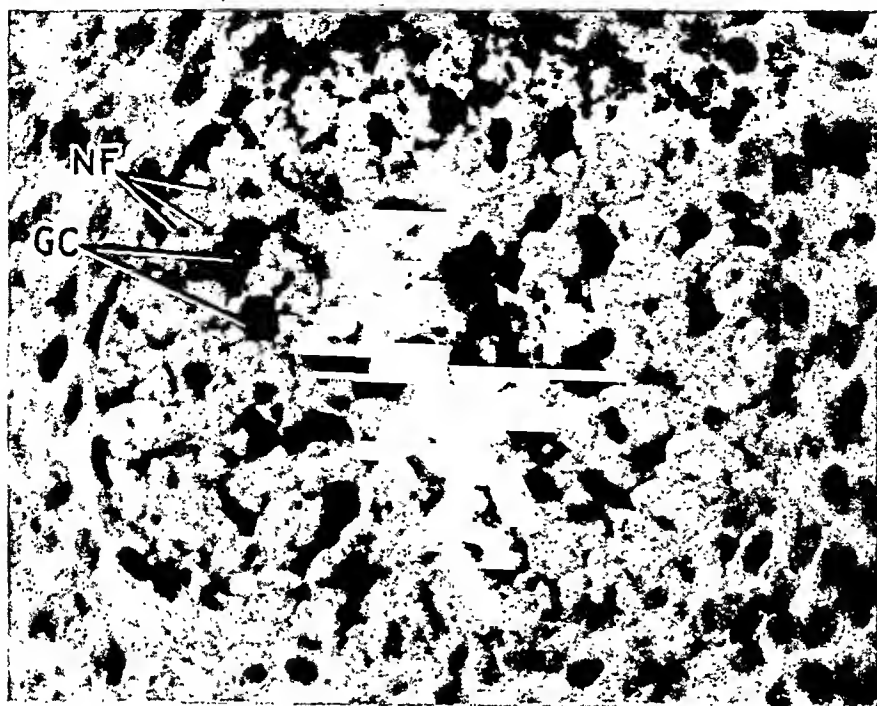


Fig. 4 (Haden). 20-mm. embryo, cross section of mid-orbital portion of optic nerve. GC, glial cells; NF, nerve fibers.

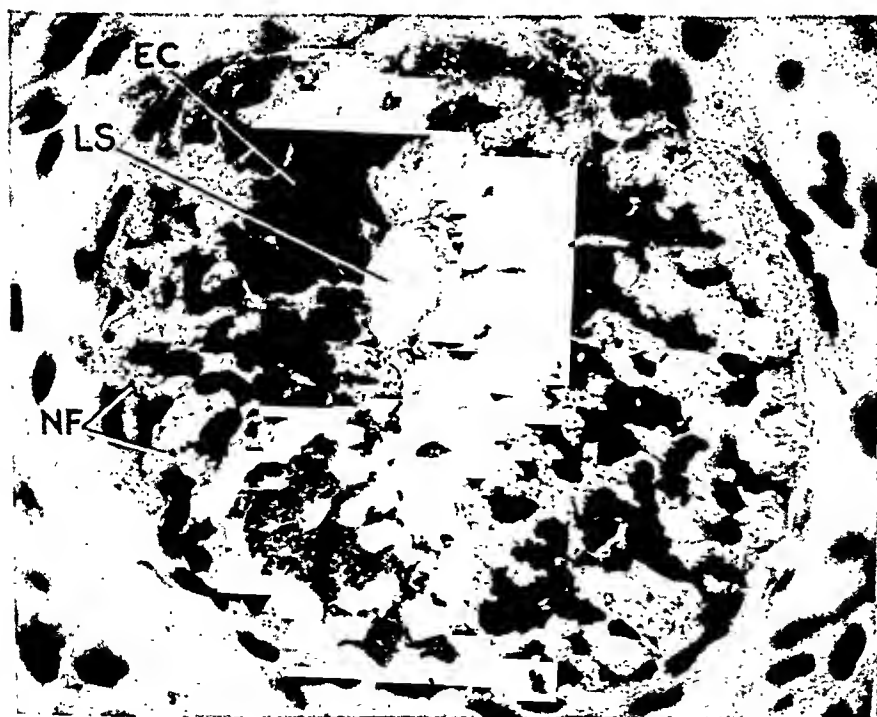


Fig. 5 (Haden). 20-mm. embryo, cross section optic nerve posterior third. LS, lumen of stalk; EC, epithelial cells; NF, nerve fibers.

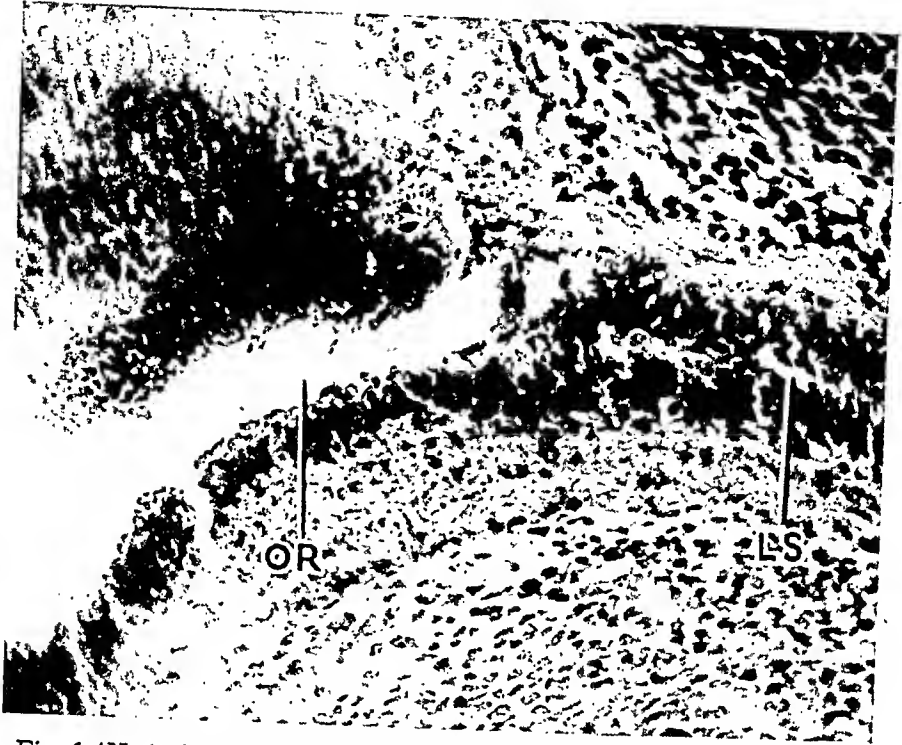


Fig. 6 (Haden). 20-mm. embryo, longitudinal section optic nerve posterior third. LS, lumen of stalk; OR, optic recess.



Fig. 7 (Haden). 29-mm. embryo, longitudinal section optic nerve.

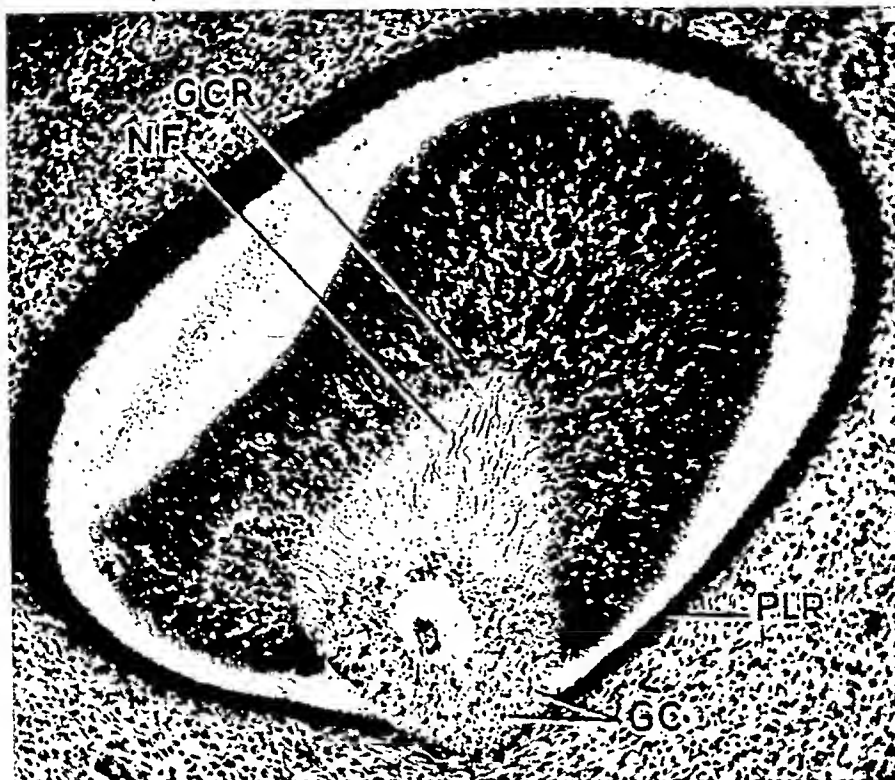


Fig. 8 (Haden). 29-mm. embryo, cross section optic nerve and oblique section of retina. GCR, ganglion cells retina; NF, nerve fibers; GC, glial cells; PLR, pigment layer retina.

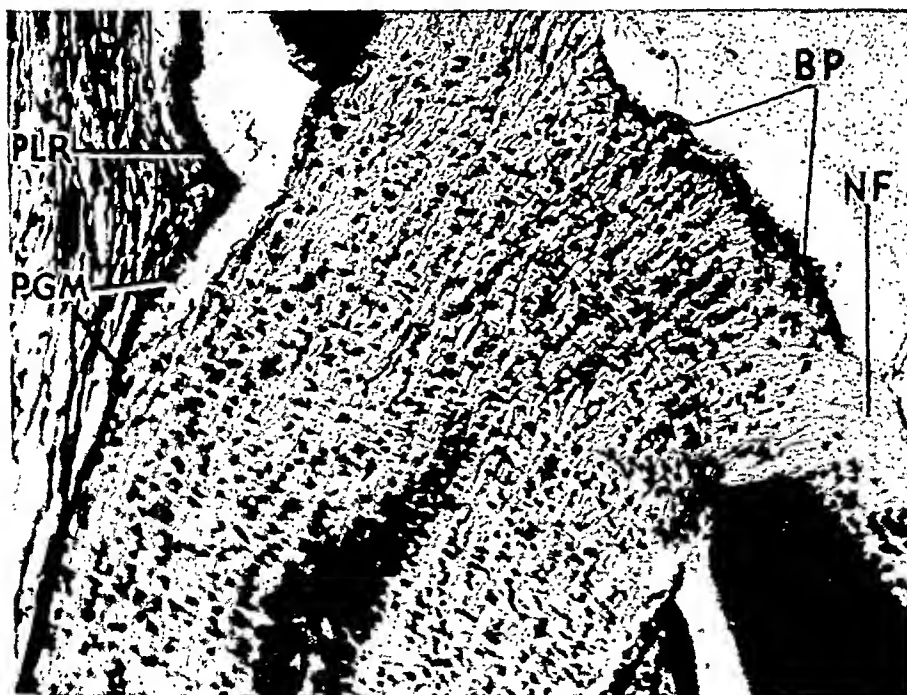


Fig. 9 (Haden). 45-mm. embryo, longitudinal section optic nerve. BP, Bergmeister's Papilla; NF, nerve fibers; PGM, peripheral glial mantle; PLR, pigment layer retina.



Fig. 10 (Haden). 67-mm. embryo, longitudinal section optic nerve. ALC, anlagen of laminae cribrosae.

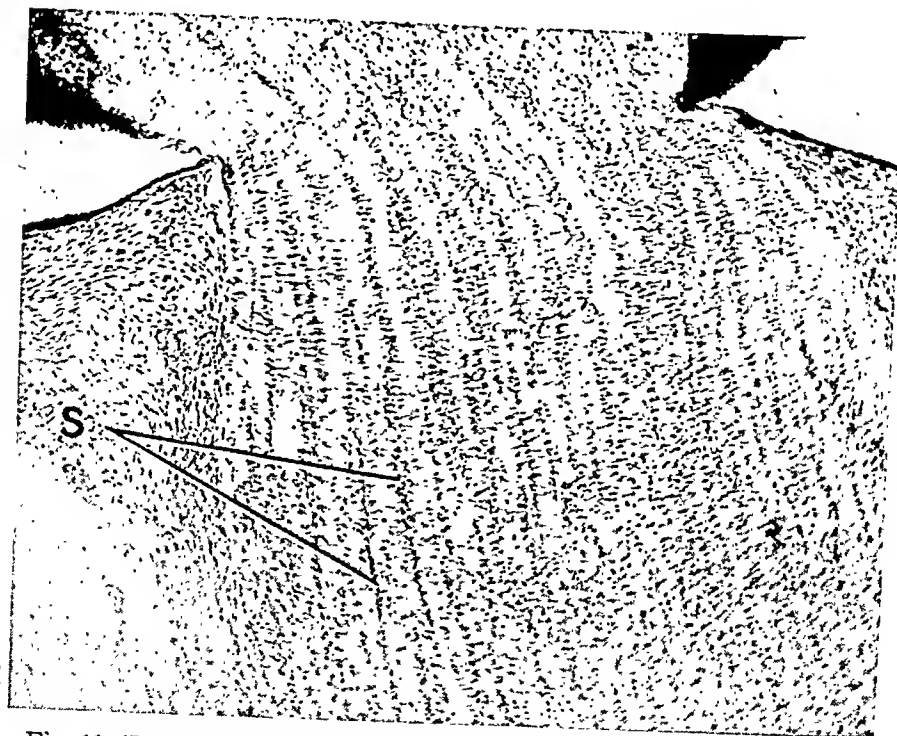


Fig. 11 (Haden). 97-mm. fetus, longitudinal section optic nerve. S, septa, glial cells, and fibrous connective tissue.

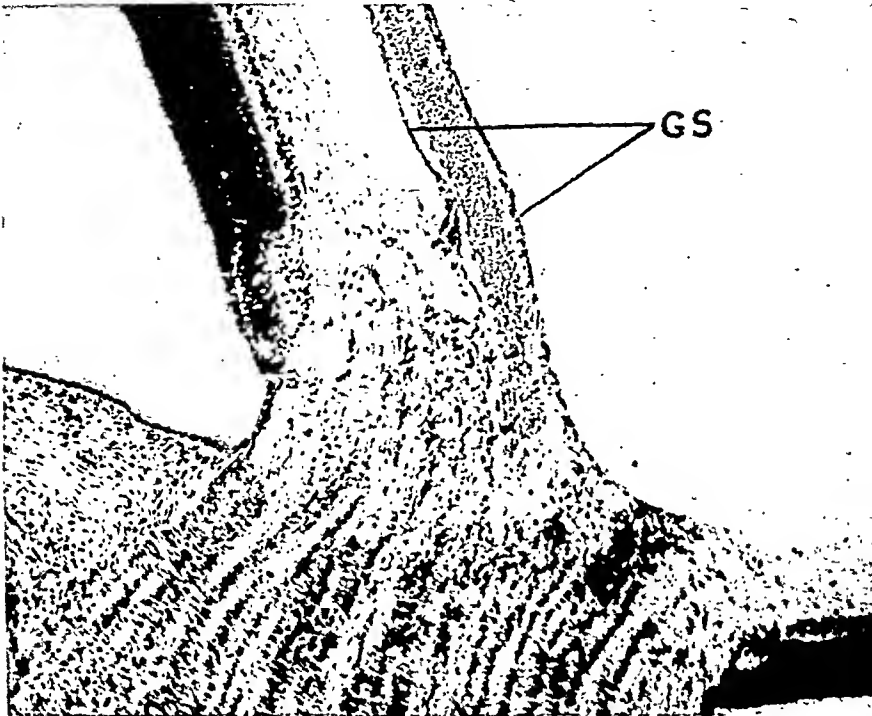


Fig. 12 (Haden). 160-mm. fetus, longitudinal section optic nerve. GS, glial sheath of hyaloid artery.



Fig. 13 (Haden). 500-mm. fetus, longitudinal section optic nerve. BT, border tissue; LS, lamina scleralis, connective-tissue lamina cribrosa; S, sclera.



Fig. 14 (Haden). 2-months child, longitudinal section optic nerve. GLC, glial lamina cribrosa (lamina chorioidalis); LS, lamina scleralis (connective-tissue lamina cribrosa).

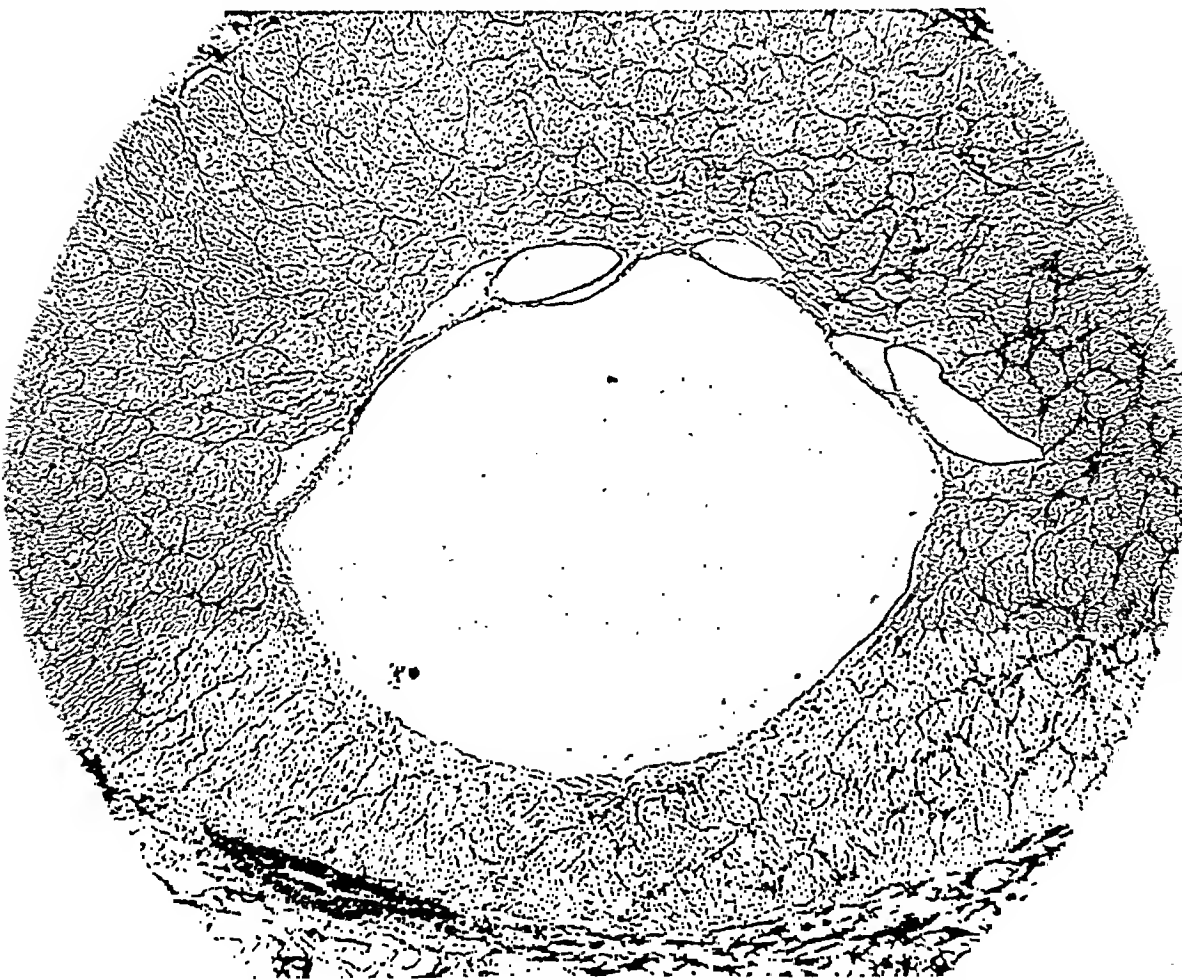


Fig. 15 (Haden). 2-months child, cross section optic nerve through glial lamina cribrosa, showing glial cells with anastomosing processes.

STREPTOMYCIN IN OPHTHALMOLOGY*

JOHN G. BELLOWS, M.D., AND CHESTER J. FARMER, PH.D.
Chicago, Illinois

Thousands of different strains and species of actinomyces, fungi, and bacteria have been investigated for antibiotic production and therapeutic usefulness; however, only penicillin and streptomycin, thus far, have proved to be of real therapeutic importance. Of the two, penicillin is far more valuable, yet streptomycin is superior to penicillin in the control of certain specific organisms. The therapeutic possibilities of streptomycin in ocular infections has aroused a great deal of interest. The literature is scanty and it must be emphasized that streptomycin therapy in ocular infections is still in the experimental stage.

Leopold and Nichols¹ have demonstrated that streptomycin administered to rabbits in dosages of 10,000 mcgm. per kg. body weight appears in the conjunctiva, sclera, extraocular muscles, and aqueous humor. Much larger doses (100,000 mcgm. per kg. body weight) are necessary for streptomycin to become detectable in the cornea, vitreous, chorioretinal tissues, and optic nerve. Streptomycin did not penetrate the intact cornea, but it readily penetrated the cornea if it was abraded or if iontophoresis was employed.

Owens² reported that an *E. coli* infection of the cornea responded satisfactorily to local treatment with this antibiotic. Alberstadt and Price³ stated that streptomycin lessens the healing time of corneal infections. We⁴ showed that intraocular injections of streptomycin, if

administered in 6 to 8 hours, prevented experimentally produced vitreous infections. We found that streptomycin was unexcelled for the treatment of experimental and clinical *B. pyocyaneus* infections of the cornea. This antibiotic was also of value in some types of acute and chronic conjunctivitis. Molitor⁵ reported that streptomycin even in the most purified form possesses neurotoxic properties. The large systemic doses required for the antibiotic to reach a detectable although not necessarily therapeutic level in the cornea, vitreous, chorioretinal tissues, and optic nerve might produce, during prolonged treatment, neurotoxic disturbances in man. If it were possible to achieve adequate therapeutic concentrations by local methods of administration, the toxic manifestations accompanying systemic administration would be avoided.

PURPOSE OF THIS REPORT

The purpose of this report is to describe the following investigations:

1. Factors which influence the penetrability of streptomycin through the cornea.
2. Local tissue tolerance following surface application and intraocular injection of streptomycin.
3. The effectiveness of streptomycin therapy in vaccinia keratitis with secondary infections.
4. Factors which influence the penetrability of streptomycin through the cornea.

EXPERIMENTAL PROCEDURE

We have confirmed the work of Leopold and Nichols in that streptomycin does not penetrate the normal cornea. In a series of normal rabbits anesthetized by intravenous injection of nembutal,

*From the Departments of Ophthalmology and Biochemistry, Northwestern University Medical School, Chicago, Illinois. This research was done under a contract between Navy Program for Basic Research and Northwestern University.

streptomycin hydrochloride, in concentrations of 5,000, 10,000, and 50,000 mcgm. per ml. of physiologic salt solution, was applied as a corneal bath by means of plastic eye cups for periods of 15 minutes to 4 hours. At the end of the designated period, the cup was removed, and the cornea and cul-de-sac were thoroughly washed with a stream of normal saline from a wash bottle. The aqueous was then withdrawn through a limbal puncture by means of a sterile 27-gauge needle attached to a tuberculin syringe. The streptomycin concentration of the aqueous was then determined by the method of Heilman⁶ using *B. megatherium*. Values of less than 6.25 mcgm. streptomycin per ml. of aqueous could not be accurately determined by this method because of the small amount of aqueous (0.2 ml.) obtainable. They were, therefore, considered negative. Fluorescein staining at the end of the period established the absence of corneal damage. Out of the entire series of 24 rabbit eyes, only one showed a measurable amount. In this single animal a concentration of 50,000 mcgm. per ml. applied for three hours resulted in a concentration of 12 mcgm. per ml. aqueous.

Since the normal cornea prevents streptomycin from reaching the aqueous, attempts were made to increase the penetrability by the following means:

1. CORNEAL PENETRABILITY OF STREPTOMYCIN

a. Iontophoresis (ion-transfer). Leopold and Nichols showed that by means of iontophoresis, streptomycin could be made to penetrate the cornea in considerable amounts so that the concentrations in aqueous reached 30 to over 70 mcgm. per ml.

In preliminary electrophoretic experiments with solutions containing 100 mcgm. of streptomycin (HCl) per ml., assay of samples taken from the electrode chambers showed a concentration of less

than 50 mcgm. at the anode and over 100 mcgm. at the cathode with currents of 0.8 to 0.9 milliamperes at 44 volts. In an extirpated rabbit eye, iontophoresis with a solution of 1,000 mcgm. streptomycin (HCl) per ml., using 22 volts and 2 milliamperes for 30 minutes with the anode connected to the solution cup and cathode inserted through the optic nerve into the vitreous, gave an aqueous concentration of 100 mcgm. per ml. In the living rabbit eye, iontophoresis of a solution containing 10,000 mcgm. per ml. for 30 minutes with a current of 2 milliamperes at 22 volts produced a concentration of 25 mcgm. streptomycin per ml. aqueous. These experiments clearly indicate that a therapeutic level of streptomycin may be achieved in the aqueous by means of iontophoresis.

b. Use of wetting agents. Bellows and Gutmann⁷ employed wetting agents with sulfonamides and showed increased concentrations in the aqueous. It, therefore, seemed logical to follow these studies in an attempt to increase penetration for streptomycin to such an extent as to obtain effective therapeutic levels in the aqueous. Using the procedure already described, one drop of aerosol (O.T.) (0.5-percent solution) was added per ml. of streptomycin solution employing concentrations of 5,000, 10,000, and 50,000 mcgm. per ml. for periods of 30 minutes, 1 hour, and 2 hours. Assay of the aspirated aqueous revealed values of 25 to 50 mcgm. per ml. when a corneal bath with a concentration of 50,000 mcgm. streptomycin per ml. of solution was used for one hour. With 5,000 and 10,000 mcgm. streptomycin per ml., the values were below 6.25 units per ml. aqueous for periods of 30 and 60 minutes. In two cases, where 10,000 mcgm. were employed for a period of two hours, values of 25 mcgm. per ml. of aqueous were obtained.

In three eyes, where 10 drops of 0.5-

percent solution of aerosol (O.T.) were added to 1 ml. of solution containing 50,000 mcgm. of streptomycin (HCl), values of over 100 mcgm. streptomycin per ml. aqueous were obtained. However, this concentration of aerosol produced macroscopic corneal changes, as evidenced by staining of the cornea with fluorescein.

These studies indicate that corneal penetration to streptomycin may be safely achieved by the cautious use of relatively low concentrations of aerosol. Further work is in progress with other wetting agents.

c. The abraded or the inflamed cornea. Leopold and Nichols report values ranging between 14 and 21 mcgm. streptomycin per ml. aqueous 15 minutes after "drop installations" of a saline solution of streptomycin containing 50,000 mcgm. per ml. in rabbits with abraded corneas. In our experiments using the eye cup, solutions containing 10,000 mcgm. or more per ml. in saline for two hours gave values of over 100 mcgm. per ml. aqueous. Clinically streptomycin will be used on inflamed corneas. For this reason a study was undertaken to determine penetrability through the infected cornea. For this purpose 15 rabbit corneas were inoculated with vaccinia. When definite signs of corneal infection were manifest, the penetration studies were carried out using the eye cup with a 10,000 mcgm. streptomycin (HCl) per ml. of saline solution for 15-, 30-, and 60-minute periods. With the exception of two eyes, the values in the aqueous ranged from 25 to 200 mcgm. per ml. There was no apparent relation between the longer and shorter intervals of bathing and the assay values. This may possibly be explained on the basis of the size of the corneal lesions. Thus, it is noteworthy that in corneal infections local applications lead to therapeutic concentration of streptomycin in the aqueous humor.

2. LOCAL TISSUE TOLERANCE OF STREPTOMYCIN

a. Effect on regeneration of the corneal epithelium. As shown by Bellows,⁸ the cornea is an excellent medium to ascertain information relative to the local tissue effect of drugs. Molitor noted that instillation in the rabbit eye of buffered solutions of streptomycin available at that time, containing "500 to 1,000 units per cubic centimeter," results in an immediate inflammatory reaction which disappears in 12 to 24 hours. Our experience with the present commercial streptomycin (HCl), as well as the highly purified streptomycin-calcium-chloride complex, shows that saline solution, containing 10,000 mcgm. per ml., upon instillation into the rabbit and human eye is well tolerated as evidenced by no greater degree of conjunctival redness than that occurring upon similar treatment with accepted ophthalmic solutions.* In a series of 30 clinical cases in which this concentration was employed for instillations into the eye, only one patient complained that the eyes seemed worse after use of the antibiotic. In no case was any injury to the cornea or conjunctiva noted.

In addition to the production of conjunctival redness and staining reaction of the cornea, another means of evaluating local toxicity of a drug is its influence upon the cornea following removal of epithelium by abrasion with sterile gauze. For these studies a series of rabbit corneas were abraded with gauze, and the completeness of denudation was established by staining with fluorescein. Of these animals, six received instillations of a saline solution of streptomycin (HCl) containing 10,000 mcgm. per ml. in the right eye, reserving the left as a control receiving saline simultaneously with the

*The samples of streptomycin used by us were kindly furnished by Dr. Robertson of Merck and Company, Inc., and show negative or minimal histaminelike effects.

treated eye. Two drops were instilled five times daily between the hours of 9 a.m. and 5 p.m. until the corneal epithelium had regenerated as evidenced by absence of

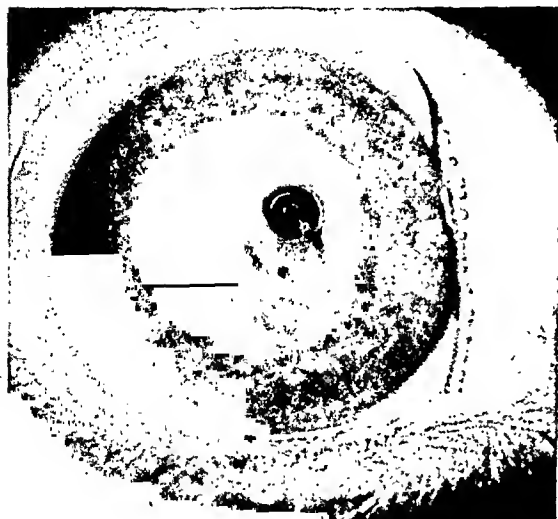


Fig. 1 (Bellows and Farmer). Abraded cornea receiving 10,000 mcgm. streptomycin per ml. saline.

staining with fluorescein. A second group of six rabbits was treated similarly with a streptomycin solution containing 50,000 mcgm. per ml., while a third group of six rabbits received 20 mg. of streptomycin powder at similar intervals.

In these experiments, corneas of the rabbits receiving instillations of the solution containing 10,000 mcgm. per ml. (fig. 1) healed at the same rate as those controlled with saline solution (3 to 5 days), thus showing no retardation in corneal regeneration due to the antibiotic solution. However, in rabbits receiving instillations of the 50,000-mcgm. concentration, there was a definite delay in healing to at least twice normal. The streptomycin powder delayed the regeneration of the epithelium even more markedly than the solution containing 50,000 mcgm. per ml. Furthermore, the cornea treated with either the 50,000-mcgm. concentration or with powdered streptomycin when finally healed showed marked vascularization

and marked scar formation (fig. 2).

Since it is generally known that agents that are noninjurious to the cornea and conjunctiva of the rabbit are equally or even less irritating to that of the human eye, it may be concluded that streptomycin in concentrations of 10,000 mcgm. per ml. saline may be safely recommended for local application to the human eye. This has been proved subsequently by our clinical experiences with this antibiotic.

b. Effect of intraocular injection of streptomycin. As previously stated, even after huge systemic doses of streptomycin barely detectable amounts are found in the vitreous. It therefore follows that this method of administration would be in-



Fig. 2 (Bellows and Farmer). Abraded cornea receiving 50,000 mcgm. streptomycin per ml. saline.

effective except perhaps in infections with the most susceptible organisms. The present study was therefore undertaken to determine the tolerance of the ocular fluids and tissues to the direct injection of streptomycin. Also, to be determined was the length of time that an effective therapeutic concentration may be expected following a single intraocular injection.

For this study, solutions of various

commercial lots of streptomycin (HCl) and a highly purified sample of streptomycin-calcium-chloride complex, in concentrations ranging from 250 to 10,000 mcgm. per ml. were prepared in saline. The respective solutions in doses of 0.1 ml. were injected with a 27-gauge needle, making the puncture at the equator of the eyeball. Caution was practiced to deposit the streptomycin as near the center of the vitreous as possible. The eyes were ob-

ophthalmoscopically was damage to the retina observed. Histologic sections of several eyes examined by Dr. Bertha A. Klien failed to reveal any changes in the tissues in those eyes receiving the injection.

The studies of streptomycin retention in the vitreous revealed between 12.5 to 25 mcgm. of streptomycin even 24 hours after its injection. Thus after a single intraocular injection of 100 mcgm. of strep-

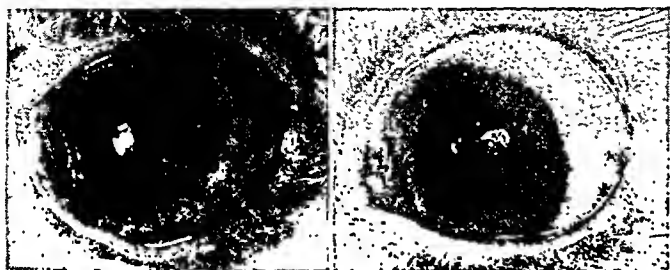


Fig. 3 (Bellows and Farmer). The picture at the left shows the vaccinia-keratitis infected control eye. At the right is the vaccinia-keratitis infected eye which has been treated with streptomycin.

served daily with the ophthalmoscope, checking with the slitlamp to confirm ophthalmoscopic observations. At varying intervals, the eyes were removed for histologic study.

For determining the retentive power of the vitreous for streptomycin, 100 mcgm. of the antibiotic in 0.1-ml. saline were injected into the vitreous in a series of rabbits. At specified intervals of 4, 8, and 24 hours the vitreous was removed and the streptomycin content determined.

The frequency and number of permanent vitreous opacities were low with the more purified commercial samples (21 eyes—6 opacities), and least with the highly purified streptomycin-calcium-chloride complex (19 eyes—4 opacities). In many instances the opacities were in the form of a "needle track" which gradually disappeared over a period of several weeks. An occasional posterior cortical or capsulo-cortical lens opacity appeared, which was attributable to trauma by the needle, or to the injection of the solution too close to the lens. In none of the animals where the fundus remained visible

tomycin, an adequate therapeutic concentration may be expected for over 24 hours.

It may be concluded that the purer commercial forms of streptomycin may safely be injected into the vitreous. The initial changes observed are in many instances transient, and will probably be less marked in the human eye because of its size. These findings are similar to those obtained by von Sallmann⁹ with penicillin. Therefore any theoretic objections to intra-vitreous injections of streptomycin in cases of infection of the vitreous with a sensitive organism are unfounded.

3. THE EFFECT OF STREPTOMYCIN ON VACCINIA KERATITIS

Our previous studies⁴ had demonstrated the value of streptomycin in certain ocular infections. The following experiments were undertaken to determine the value of streptomycin in experimental vaccinia infections of the cornea in rabbits, and to study its effect on the accompanying secondary infection.

In a series of normal rabbits anesthetized by intravenous injections of nembutal, an area of each cornea was outlined with a 4-mm. trephine. The epithelium within this area was abraded by a knife, following which a drop of vaccinia was placed on the abraded region and the eye was kept open for 60 seconds. Previous experiments had shown that uniform infections of the cornea were obtained by this means. One hour after the inoculation, drops of streptomycin (10,000 mcgm. per ml. saline solution) were instilled into the right eye. These instillations were made three times daily until the end of the experiment. Before the inoculation and every morning at the same hour before daily treatments were started (about 16 hours after the last streptomycin had been applied the previous day) a single platinum loopful of material was taken from each conjunctival sac and inoculated on blood agar. Twenty-four hours later organisms were identified and colonies were counted. The two main organisms were *Neisseria catarrhalis* and *Hemolytic staphylococcus albus*. The results of the bacteriologic observations showed that up to the sixth day no differences in the number and type of organisms were noted.

However, after this period the number of colonies from the treated eye was con-

sistently lower than in the control eye. As a result of the decreased amount of secondary infection in the treated eyes, the degree of scarring and vascularization in 80 percent of the corneas was much less marked than in the untreated eyes (fig. 3).

SUMMARY

The penetrability of the cornea to streptomycin may be increased by abrasion, inflammation, ion-transfer, and wetting agents.

Streptomycin is safe and nonirritating to the surface of the eyeball in concentrations up to 10,000 mcgm. per ml. Higher concentrations delay the regeneration of the epithelium and promote scarring and vascularization of the cornea.

Intravitreal injections of 500 mcgm. of streptomycin in 0.1-ml. saline are well tolerated.

The vitreous retains an effective therapeutic concentration for over 24 hours following the intraocular injection of 100 mcgm. of streptomycin.

Local application of streptomycin decreases the amount of secondary infection accompanying vaccinia infections of the cornea. As a result of this, there is less scarring and vascularization of the corneas of the treated eyes.

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OPERATIVE TECHNIQUE OF VITREOUS REPLACEMENT*

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The purpose of this paper is to present in detail the simple and nontraumatizing technique of substituting a given amount of a patient's clear cerebrospinal fluid for an equal amount of cloudy vitreous. In developing the technique, which any well-trained ophthalmologist will find easier than standard operations for cataract or filtration operations for glaucoma, the simplest manipulation with the least complicated instruments was constantly sought after. The development of expensive and complicated apparatus was carefully avoided. Full advantage was taken of the published work of earlier investigators^{1,2} on this problem, and of the cheerful generosity of the Research Department of Becton, Dickinson & Company, Inc., of Rutherford, New Jersey, who helped to develop and who supplied, gratis, the needles and syringes, which are the only special apparatus needed to perform this operation easily and successfully.

Using aseptic technique, a spinal tap is performed on the ward as short a time as possible before the operation. About 4 cc. of cerebrospinal fluid are collected in a dry, powder-free, cotton-stoppered, sterile test tube, which is carried directly to the operating room, where it is transferred into a sterile, dry, dust-free medicine glass on the instrument tray. Besides the ordinary instruments needed to perform an operation on the extraocular muscles, the following special items are required:

- 1 2-pronged corneal pick.
- 1 tube of 4-0 plain catgut on a cutting atraumatic needle.

1 tube of 4-0 black silk on a cutting atraumatic needle.

2 2½-cc. Luer-Lok syringes.†

2 Special 18-gauge needles with stylets.†

The pick is used to steady the globe when placing the purse-string suture of 4-0 plain catgut at the elected puncture site. The two special syringes are constructed with minimal clearance between plunger and syringe wall in order to avoid air leaks when suction on the vitreous is made, and the needles (fig. 1) have a stylet.

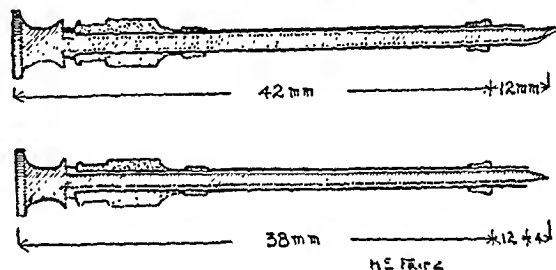


Fig. 1 (Fritz, *et al.*). Two needles used in the substitution of cerebrospinal fluid for cloudy vitreous.

let to prevent loss of vitreous when puncture of the sclera is made. One type of needle is cut off at right angles to the shaft so that no point exists to injure the retina or the lens when the eye collapses as vitreous is withdrawn. There is a stop, 12 mm. from the end of the needle, to prevent too deep penetration of the needle into the vitreous chamber at the time of puncture.

Under pentothal sodium or local anesthesia, adrenalin (1:1,000) and pontocaine (0.5 percent) are applied to the eye topically. The eye speculum is inserted between the lids. A conjunctival incision is made parallel to and about 5 mm. from

* From the Eye-Bank for Sight Restoration, Inc. The expenses connected with this research were met by The Florence Ellsworth Wilson Memorial Fund Fellowship in Ophthalmology.

† Available upon special order from Becton, Dickinson & Company, Rutherford, New Jersey.

needle and the empty $2\frac{1}{2}$ -cc. special syringe is inserted into the hub of the needle which has already been inserted up to its stop in the vitreous chamber. Gentle suction is then produced carefully, moving the syringe and needle in and out and from side to side until from $1\frac{1}{4}$ - to $2\frac{1}{4}$ -cc. of cloudy vitreous are withdrawn. All the vitreous that can be withdrawn without undue suction or trauma is taken and the amount varies, for reasons as yet unknown, between the quantities mentioned. As the globe collapses like a punctured basketball, the needle is not allowed to penetrate more deeply, and the position of the intravitreal end of the needle in relation to the lens and retina opposite is constantly kept in mind.

The syringe containing $2\frac{1}{2}$ cc. of cerebrospinal fluid is now substituted for the one containing all the vitreous that could be aspirated. The fluid is then gently injected into the eye, which assumes its normal shape. With the index finger on the plunger, to prevent regurgitation of fluid into the syringe, the tension of the globe is determined with a squint hook, and it will usually be found that the amount of cerebrospinal fluid injected roughly equals that of the vitreous withdrawn. An extra drop or two of fluid may be injected without harm, the eye being left a little harder, if anything, than is judged to be normal. The assistant then makes a half hitch in the purse string, and draws it up snugly about the needle shaft, whereupon needle and syringe are withdrawn from the vitreous chamber. The assistant then completes the knot on the purse-string suture. Before withdrawing the needle, a glance through the dilated pupil can reveal the needle point in the vitreous chamber. The conjunctiva is then closed with the 4-0 silk suture. A 1-per-cent atropine-sulphate ointment is placed in the conjunctiva, and a single eye patch is applied. If the operator wishes to do so,

an ophthalmoscopic examination may briefly be made and some idea of the ultimate result may be ascertained before ointment and dressing are applied.

COMMENT

In the development of this experiment, cerebrospinal fluid was considered ideal for several reasons. In the first place, it is easily available and doubtless has the same immunologic and other properties common to the body fluids of the individual patient. It is a substance more like vitreous than any other substance, with the exception of vitreous taken from a donor eye. Yet the properties of turgescence and deturgescence characteristic of a gel (and vitreous is considered to be one³) militate against the use of vitreous; whereas, cerebrospinal fluid being a sol does not change its volume. What happens to the mixture of cerebrospinal fluid and residual vitreous in the eye is as yet unknown.

Here at the Eye-Bank, the use of vitreous transplants (according to the method of Cutler⁴) from eyes enucleated elsewhere as donor eyes was considered. It has been found, however, that culture of the outside surface of such eyes⁵ often yields bacterial growth. The effectiveness of the sclera and cornea as barriers against bacterial contamination of the vitreous is unknown. It is known that the vitreous of living human eyes is an excellent culture medium for bacteria, hence it was not considered justifiable to inject vitreous of doubtful sterility into the eyes, even though partially blind, of living human beings.

Refrigerated human eyes were used in the development of the needles and syringes. It was found that no more than $2\frac{1}{4}$ cc. of vitreous could be withdrawn, without undue suction or trauma, from enucleated normal eyes from 12 to 72 hours after enucleation at temperatures

from 34° to 72°F. No retinal detachment or ectopia lentis, which could with certainty be blamed on the aspiration of vitreous, was ever seen in these eyes. For these reasons, cauterization about the puncture site of living eyes and complicated pieces of apparatus, which would allow simultaneous injection and withdrawal of vitreous to maintain intraocular tension constant, were deemed superfluous.

The stop was placed on the shaft to prevent too deep penetration of the needle and stylet at the time of puncture. However, it must be remembered that this stop does not prevent the likelihood of scraping the lens or opposite retina as the eye collapses, unless this danger is kept constantly in mind. So far this has not hap-

pened in the refrigerated or living eyes. In fact, as withdrawal and injection are done, the eye should be suspended from the needle, rather than being allowed to sink into the eye as it collapses.

The stylet was used to supply a cutting point and to prevent loss of vitreous before the syringe could be placed in the needle, and the elimination of the needle point was thought to lessen the danger to ocular structures.

It is hoped that this detailed report will encourage ophthalmologists with suitable cases to perform this useful operation in order that its true place in the treatment of certain ocular conditions may be determined.

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BILATERAL GRANULOMATOUS UVEITIS FROM THE USE OF HORSE SERUM IN RABBITS*

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This report concerns a continuation of studies on the reaction of the rabbit eye to horse serum. In 1943, Davis and I found a close resemblance to the histopathologic picture of sympathetic ophthalmia in rabbit eyes injected with normal horse serum, but there was no evidence of uveitis in the opposite eyes.¹ By the use of another method,² consisting of an intraocular injection followed by one intravenously, a slight choroidal infiltration was found in 40 percent of the uninjected eyes. The purpose of the present investigation was to see if this contralateral uveitis could be increased.

This production of a uveitis in the uninjected eyes calls attention to the problems of sympathetic ophthalmia and of bilateral granulomatous uveitis. Sympathetic ophthalmia has never been produced in animals despite numerous attempts, but it has been roughly simulated by a number of investigators. In 1918, Woods, using an emulsion of homologous uvea injected into one eye, followed later by an intraperitoneal shocking dose, produced a sympathizing reaction in the contralateral eyes of dogs consisting of a round-cell infiltration of the anterior uvea but without epithelioid or giant cells.³ In 1924, von Szily produced a bilateral intraocular inflammation with lymphocytes and epithelioid cells by inoculating the herpes virus into one eye only.⁴ In 1924 and 1925, Guillery introduced capsules containing tubercle bacilli into the vitre-

ous of one eye of rabbits and produced a bilateral uveitis resembling sympathetic ophthalmia.⁵

In 1929, Riehm concluded that horse serum absorbed from one eye produced an elective sensitivity in the fellow eye, resulting in uveitis after intravenous injections in pigmented rabbits but not in albinos.⁶ He did not subject the pigmented and albino rabbits to identical procedures and apparently did not make a histologic study. By using a larger number of rabbits, identical procedures, and histologic study, I demonstrated, in 1944, an equal reaction in the eyes of pigmented and albino rabbits after an intraocular followed by an intravenous injection of normal horse serum.²

In 1929, Marchesani reported a contralateral reaction from repeated injections of avirulent organisms into one eye of rabbits. He first used *Bacillus subtilis*⁷ and later *Bacillus xerosis* and *Staphylococcus albus*.⁸ The lesion consisted of loose, nodular accumulations of mononuclear cells of various types. Marchesani concluded that the contralateral response was due to uveal allergy, but an allergic basis was disputed by von Szily⁹ who showed that similar lesions could be produced by intravenous injections and by Iga who added that injections into an empty orbit would do the same.¹⁰

Friedenwald and Rones, in 1931, found essentially similar lesions in the human choroid as a result of septicemia and called this loose infiltration by mononuclear cells a "septic choroiditis."¹¹ Lucic, in 1939, used repeated intracutaneous injections of a combined culture of diphtheroids and a toxin-producing staphylococcus treated with tricresol to sensitize

* From the Research Division and the Department of Ophthalmology of the Indiana University Medical Center. Presented at the 16th scientific meeting of the Association for Research in Ophthalmology, Inc., at Atlantic City, June 10, 1947.

a group of rabbits. As a result of subsequent intraocular, intravenous, and intracarotid injections of *B. hoffmannii*, a contralateral response with epithelioid cells, giant cells, and pigment phagocytosis developed in the contralateral eyes.¹²

PRELIMINARY INVESTIGATION

In a search for the most favorable conditions for a contralateral response, a group of 38 rabbits was used to determine whether 1 or 2 weeks between intraocular and intravenous injections was the best interval and whether doses of 5, 10, 20, or 30 cc. of horse serum intravenously gave the best response.

MATERIALS AND METHODS

Normal pigmented rabbits weighing from 4 to 7 pounds were examined with the aid of a flashlight, and those with diseased eyes were discarded. The right eyes were prepared with drops of 4-percent butyn and 1:1,000 merthiolate solution. The lids were opened manually by an assistant while a 25-gauge needle on a tuberculin syringe was used to make the intravitreal injection about 7 mm. behind the limbus in the 12-o'clock meridian. One-tenth of a cubic centimeter of sterile normal horse serum* preserved with 1:10,000 merthiolate was then injected. Most of this volume regurgitated leaving a subconjunctival bleb.

Both eyes were examined three times a week with flashlight and ophthalmoscope. After an interval of 1 or 2 weeks, an intravenous injection of either 5, 10, 20, or 30 cc. was given in the marginal ear vein. A week later the animals were killed by air embolism. The right eyes were subjected to six, and the left eyes to 12 scattered sections all stained with hematoxylin and eosin.

* Supplied by Eli Lilly and Company.

RESULTS

Almost immediately after the intravenous injections, some of the rabbits went into anaphylactic convulsions and died. Many developed body sway, vestibular nystagmus, and head tilt. Weakness was common, with a few dying during the next two days. Of the 38 rabbits, 28 survived until the proper time for enucleation. Microscopic study of this latter group indicated that about 80 percent of the uninjected left eyes developed a mild mononuclear infiltration of the uvea typical of mild reactions observed in injected eyes. It was found that the 2-week interval between intraocular and intravenous injection, and the 20-cc. dose were best for the production of a contralateral uveitis.

EXPERIMENT 1

Right intraocular injection followed by repeated intravenous injections. The right eyes were injected as before. Repeated intravenous injections were used; the first was delayed for three weeks and subsequent ones were given at intervals of one week. Thirty-seven rabbits were divided into three groups to be enucleated one week after 2, 3, or 4 weekly intravenous injections of 20 cc. of sterile normal horse serum. The eyes were prepared, injected, examined, sectioned, and stained in the same manner as in the preliminary investigation.

CLINICAL OBSERVATIONS

As a result of the repeated injections, only 12 of the 37 rabbits lived to the time for enucleation. In Figure 1 the reactions in the anterior ocular segment are plotted to demonstrate the average severity of the reaction on each day of the experiment. The reactions were graded from 0 to 4. Plus 1 indicates a slight conjunctival injection; plus 2, moderate bulbar conges-

tion and slight iritis; plus 3, conjunctival chemosis, pronounced bulbar congestion, and moderate iritis; plus 4, extreme chemosis and bulbar congestion, with strands of exudate over iris and pupil. Because the bulbar congestion almost disappeared during the later stages of the experiment, these criteria were varied for the later stages to include other signs such as a capsular clouding of the lens, haziness of the cornea, corneal vascularization, and keratectasia.

The clinical course can be described best by considering the periods between injections.

Features during the three weeks prior to intravenous injections

Right eyes. Following the injection into the right eyes, there was only a minimal reaction consisting of a slight circumcorneal hyperemia and a hazy vitreous in one fourth of the cases. At the end of five days this haze had increased until the visibility of the fundus was poor. The retinal vessels often were dilated. On the ninth day the reaction in the right eyes was pronounced and was rated at plus 2 or plus 3 in many of the rabbits. Fibrinous and cellular exudates were common on the irides and on the anterior lens capsules. Thereafter the fundi of the right eyes in most cases could not be visualized because of cloudy vitreous and anterior capsular opacities. When the fundi could be seen, vitreous veils were common, especially in the region of the retinal vessels. By the end of this 3-week period most of the bulbar congestion had disappeared, but some eyes with keratectasia were graded plus 3.

Left eyes. No reaction was observed for about two weeks. Then a mild dilatation of the retinal arteries and veins appeared.

Features during the week following the first intravenous injection

Right eyes. The reactions in the anterior ocular segment were again pronounced and more severe than before, usually plus 3 or plus 4.

Left eyes. Some of the left eyes began to present mild evidence of reaction, such

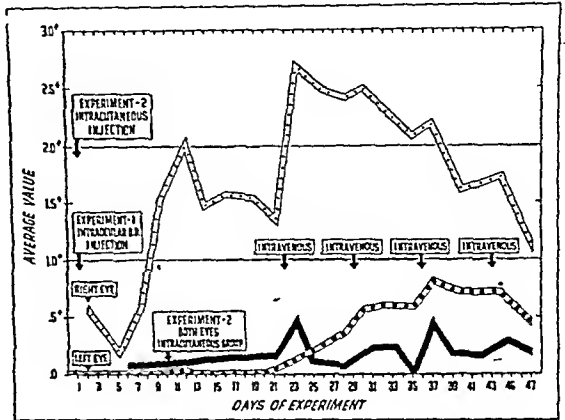


Fig. 1 (Schlaegel). The average intensity of reaction in the anterior ocular segment in right and left eyes of Experiment 1 and both eyes of Experiment 2 plotted against the time interval in days.

as slight circumcorneal injection and slight signs of iritis. In one case spots of cellular exudate were found on the anterior lens capsule. The severity of the reaction increased gradually during this week and a pronounced vitreous veil developed in one eye.

Features following second intravenous injection

Right eyes. There was a slight peaking of the response and then a gradual decline due to lessening of congestion.

Left eyes. The reaction remained roughly constant. There was nothing remarkable about the fundi until three days later when choroidal exudates developed along the retinal vessels and in the periphery along with haziness of the vitreous.

Features following third intravenous injection

Right eyes. Again there was only a slight congestive response with a subsequent decline of the degree of hyperemia. Two of the right eyes had generalized corneal relucence; one case developed *occlusio pupillae*, and another, corneal vascularization.

Left eyes. All left eyes were involved. In two thirds of them choroidal exudates were seen.

Features following fourth intravenous injection

Right eyes. The reaction was less than before with a continued abatement of congestion.

Left eyes. Engorgement and tortuosity of the veins and a haziness of the disc were prominent findings. The choroidal exudates were still visible.

EXPERIMENT 2

Intracutaneous injection followed by repeated intravenous injections. In an attempt to elucidate the mechanism of the contralateral ocular response of the first experiment a group of 16 rabbits were each given an intracutaneous injection instead of a right intraocular injection. One tenth of a cc. of sterile normal horse serum preserved with merthiolate was injected into the epidermis producing a distinct bleb. Otherwise these rabbits were treated as in the first experiment.

CLINICAL OBSERVATIONS

In Figure 1, it can be seen that the average response in the anterior ocular segment shows a peaking in the intensity of the reaction after each intravenous injection, but that the general sweep of the reaction did not reach the intensity of the left or contralateral eyes in the first experiment.

After the first intravenous injection the

retinal vessels appeared slightly dilated and tortuous. Choroidal exudates along the retinal vessels and in the periphery, haziness of the media, and haziness and hyperemia of the disc appeared during the following days. In general, the fundus picture was very similar to that in the uninjected eyes of the main experiment except that it was not as frequently seen nor as pronounced in development.

Figure 1 demonstrates that a pronounced reaction was present in the injected right eyes nine days after the intraocular injection of horse serum. Appreciable reactions appeared in the left or contralateral eyes around nine days after the intravenous injections were begun, while the curve of the intracutaneous group shows only slight peaking after each one. Figure 1 also indicates, especially in the injected eyes, a decline in the intensity of the reactions in the anterior ocular segment after the later intravenous injections. This phenomenon may be due to desensitization as a result of the large doses of serum.¹³

In Table 1, the clinical features of the three groups are summarized.

In addition to 12 scattered sections of both right and left eyes of the intracutaneous group, sections of muscle, liver, kidney, lymph nodes, spleen, lung, heart, and small and large intestine were obtained to see whether the horse serum produced a generalized response. A minimal reaction was found only in the myocardium and kidney, consisting of small accumulations of mononuclear cells. This minimal infiltration is of little significance because it may have been caused by other factors.

OCULAR HISTOPATHOLOGY

In all three groups the choroid is the tissue most involved. There is only slight infiltration of the anterior uvea.

Injected eyes. Eye sections of rabbits



Fig. 2 (Schlaegel). Injected eye of a rabbit which died immediately after the second intravenous injection. The choroid has been increased to 20 times its normal thickness. There is an extension of the infiltration into the inner lamellae of the sclera.



Fig. 3 (Schlaegel). Injected eye of a rabbit which received three intravenous injections. This case shows the most striking absorption of the infiltrate and its replacement by fibrous tissue. The choroid and retina have been converted into fibrous membranes.

which died early show the choroid of injected eyes to be heavily infiltrated with pale areas of epithelioid and occasional giant cells in no definite arrangement, lying in a darker field of lymphocytes,

plasma cells, and large mononuclears (fig. 2). After 5 to 7 weeks the cellular infiltration is being replaced by fibrous tissue (fig. 3). This fibrosis involves both the retina and choroid. In one eye in which there was a tremendous thickening of the

TABLE 1

CLINICAL FEATURES IN RIGHT AND LEFT EYES OF 37 RABBITS OF EXPERIMENT 1 (FIRST INJECTIONS IN RIGHT EYES) AND IN BOTH EYES OF 16 RABBITS OF EXPERIMENT 2 (FIRST INJECTIONS IN SKIN)

Objective Signs	Experiment 1		Experiment 2
	Right Eyes (injected)	Left Eyes (uninjected)	Both Eyes (uninjected)
Early			
Circumcorneal injection	+	+	+
Fibrin in anterior chamber	+	0	0
Vitreous haze	+	+	+
Blurring of iris pattern	+	+	0
Anterior Segment			
Haziness of cornea	+	+	0
Corneal vascularization	+	0	0
Keratectasia	+	0	0
Posterior synechiae	+	0	0
Occlusio pupillae	+	0	0
Iris bombé	+	0	0
Capsular clouding of lens	+	+	0
Fundus			
Veils in vitreous	+	+	0
Congestion of retinal vessels	+	+	+
Hyperemia and blurring of disc	+	+	+
Chloroidal exudates	+	+	+
Pronounced vitreous haze	+	0	0



Fig. 4 (Schlaegel). Cellular infiltration of extraocular tissues.

former retina by heavy fibrous tissue, the use of special stains, including phospho-

tungstic acid hematoxylin, demonstrated an absence of gliosis.

One of the severely reacting injected eyes will be described. It was the only case sectioned that showed appreciable corneal changes.

Description of one injected eye

Mononuclears, especially plasma cells, are found between the lamellae of the anterior two thirds of the cornea. Capillary loops extend to near the center of the cornea in the infiltrated region. A heavy collection of mononuclear cells is found superficially at the limbus. In its posterior portion, the iris is mildly infiltrated mainly with plasma cells. A heavy fibrous cyclitic membrane stretches out from the

TABLE 2

HISTOPATHOLOGIC FEATURES IN RIGHT AND LEFT EYES OF 12 RABBITS OF EXPERIMENT 1 (FIRST INJECTIONS IN RIGHT EYES) AND IN BOTH EYES OF 7 RABBITS OF EXPERIMENT 2 (FIRST INJECTIONS IN SKIN)

Histopathologic Features	Experiment 1		Experiment 2
	Right Eyes (injected)	Left Eyes (uninjected)	Both Eyes (uninjected)
General Features			
Infiltration almost entirely in uvea	+	+	+
Thickening due to: lymphocytes	+	+	+
large mononuclear phagocytes	+	+	+
plasma cells	+	+	rare
epithelioid cells	+	+	rare
giant cells	+	0	0
Dark areas of various mononuclear cells	+	+	0
Pale areas of epithelioid cells	+	+	0
Slight pigment phagocytosis	+	0	0
Iris infiltrated in posterior layers	+	+	0
Choroid			
Main site of cellular infiltration	+	+	+
Thickened to 5 times normal width	+	+	0
Late absorption of infiltrate with fibrosis	+	—	—
Sclera			
Cells infiltrate the inner lamellae	+	+	0
Mantle formed around perforating vessels	+	+	0
Pigment Epithelium			
General disintegration	+	0	0
Nodules resembling Dalen-Fuch's type	+	0	0
Orbit			
Infiltration of subconjunctival tissues	+	+	0
Infiltration of orbital tissues	+	+	0
Retina			
Late disorganization and fibrosis	+	—	—
Mild infiltration after necrosis	+	—	—

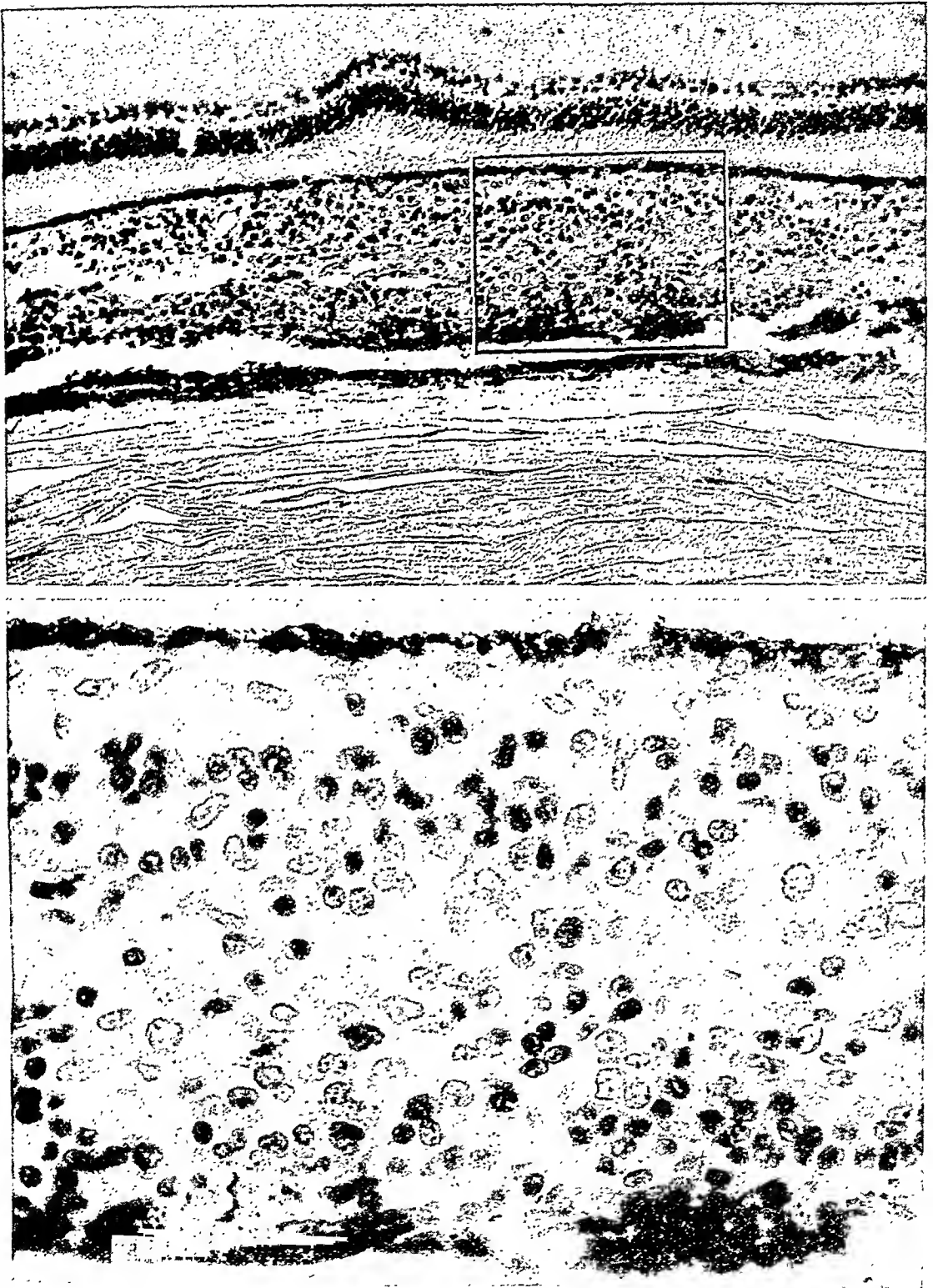


Fig. 5 (Schlaegel). Contralateral eye. *Above*: The choroid has been bulged up to five times its normal thickness by an infiltration with lymphocytes, large mononuclear phagocytes, plasma cells, and by areas of epithelioid cells. *Below*: High power of area outlined above.

ciliary body and extends behind the lens. The retina and choroid have been converted into one common membrane. The retina is necrotic and no longer recognizable. It is mildly infiltrated by extension from the choroid. The choroidal infiltration, consisting mainly of plasma

TABLE 3

SEVERITY OF UVEITIS UPON MICROSCOPIC EXAMINATION OF RIGHT AND LEFT EYES OF EXPERIMENT 1 (FIRST INJECTIONS IN RIGHT EYES) AND IN BOTH EYES OF EXPERIMENT 2 (FIRST INJECTIONS IN SKIN), GROUPED ACCORDING TO TIME OF ENUCLEATION

	Experiment 1 Right Eyes (injected)	Left Eyes (uninjected)	Experiment 2 Both Eyes (uninjected)
After Second Intravenous:			
	3.0	2.0	1.0
	4.0	2.0	1.5
	2.0	1.5	0.5
	3.0	3.0	1.0
Mean	3.0	2.12	1.0
After Third Intravenous:			
	4.0	1.5	1.0
	3.0	1.5	1.0
	3.0	1.5	1.0
	3.0	1.0	0.5
Mean	3.25	1.37	.87
After Fourth Intravenous:			
	3.0	1.5	1.0
	4.0	2.5	1.5
	2.5	1.0	1.0
	4.0	2.5	1.0
	—	—	0.5
	—	—	0.5
Mean	3.37	1.87	.9
Mean of 3 groups	3.2	1.8	.9

cells has become somewhat thinned out and the fibrous tissue more abundant. The cells from the choroid have extended into the inner lamellae of the sclera and they form a mantle around the perforating vessels. The orbital tissues are involved by the same type of cells (fig. 4). At the optic disc the nerve and its septa are mildly involved and there is an extension

of the choroidal infiltration back along the leptomeninges.

Contralateral eyes. In the uninjected left eyes of Experiment 1, microscopic study reveals cellular infiltration in every case. Although the degree of cellular infiltration is greater than in a previous experiment² and in the preliminary test of this investigation, it is not as severe as in the injected eyes (table 3). This contralateral infiltration consists of large mononuclears, lymphocytes, plasma cells, and epithelioid cells bulging the choroid up to five times its normal thickness (fig. 5). No giant cells or large epithelioid cell aggregates were produced.

Description of one contralateral eye
There is a mild mononuclear infiltration in the superficial tissues at the limbus. There is only a minimal infiltration of the posterior half of the iris, the choroid being the tissue most involved. This choroidal infiltration is diffuse with nodular bulgings. It has caused a mild infiltration of the inner lamellae of the sclera, and a mantle around the perforating vessels. There are a few collections of cells in the orbital tissues. The ciliary body is mildly involved in its inner and posterior portions. The cornea, retina, pigment epithelium, and optic nerve remain uninvolved.

Three main features serve to differentiate the injected response from that in the contralateral eyes: (1) Heavier cellular infiltration. (2) Distortion, necrosis, and infiltration of the retina. (3) Replacement fibrosis.

Eyes of the group sensitized by intracutaneous injection. In some of the eyes the choroidal infiltration is so slight that it is difficult to tell whether wandering cells are present. The choroid is the only tissue involved. There is only a minimal diffuse infiltration of lymphocytes and large mononuclear phagocytes. Plasma

cells and epithelioid cells are seldom seen. The impression gained is that of a mild replica of the reaction in the other two groups.

In Table 2, the histopathologic features of the three groups are outlined. In Table 3 is shown the degree of histopathologic response in each eye sectioned. This table clearly demonstrates a severe reaction in the injected eyes, a moderate response in the contralateral eyes, and a minimal reaction in the eyes of the intracutaneous group. It also shows that there is no significant difference between the reactions when 2, 3, or 4 intravenous injections were used. Replacement fibrosis in injected eyes, however, was more common and prominent after the longer intervals. The criteria for the grading of the histopathologic response are as follows: Plus 1, minimal uveal infiltration by lymphocytes and large mononuclears; plus 2, the infiltration including plasma and epithelioid cells fills the whole thickness of the choroid; plus 3, moderate distension of the choroid by the infiltration; plus 4, pronounced distension of the choroid by an infiltration which includes giant cells.

CONTROLS

Two minor controls were negative.

1. *Twenty normal rabbit eyes* were sectioned to determine the amount and type of cells normally found in the rabbit uvea. Each eye was subjected to six scattered sections stained with hematoxylin and eosin. The thinness and compact structure of the choroid was a striking feature. There was no evidence of wandering cells in the choroid of any of these eyes, but in the irides, plasma cells were common in the posterior one third of a few sections.

A study of these normal control eyes confirmed the reality of the cellular infiltration in the uninjected eyes of Experiments 1 and 2.

2. *To check on the possibility that the merthiolate preservative in the horse serum played a role in the histopathologic response*, a group of seven rabbits were each given a right intraocular injection of 0.1 cc. of 1:10,000 solution of merthiolate. (This solution was made roughly isotonic by mixing one part of a 1:1,000 solution of merthiolate with nine parts of sterile normal saline.) The right eye of one of these rabbits was enucleated each week and subjected to three scattered sections. Upon microscopic study no lesions were noticed, so it may be concluded that the merthiolate played no direct role in the production of the histopathologic picture.

COMMENT

1. LOCALIZATION OF THE CELLULAR REACTION IN THE UVEA

A striking characteristic of the reaction of the rabbit eye to horse serum is the localization of the cellular infiltration in the uveal tract. In the injected eyes there is no infiltration into the retina until it has become completely disorganized and the membrane of Bruch largely destroyed. In the uninjected eyes the retinas are unaffected and involvement of the sclera appears to be due to direct extension from the choroid. One might expect the uvea to be the site of predilection after intravenous horse serum because of its rich vascular character, but the uvea is also the site of predilection after a single injection into the vitreous. This uveal reaction is not explained by the studies of Thompson, Gallardo, and Khorazo who found no precipitins in the retina and choroid following intravenous egg albumin.¹⁴ The greatest precipitin concentration was found in the corneal-tissue juice. Although several injected eyes of the present experiment developed vascularization of the cornea, such a reaction was unusual while the uvea was involved in every case.

This predilection of cellular infiltration for the uveal tract is not confined to the effects of horse serum. It has been demonstrated over a period of many years by numerous investigators using various substances. Marchesani, for example, described, after repeated injections of avirulent organisms into one eye, a reaction in the choroid of the contralateral eyes that apparently would be hard to differentiate from the effects of horse se-

ferences in the cellular infiltration among the three groups (injected, contralateral, and intracutaneous) seem to depend entirely upon the differences in the severity and duration of the response.

A. Correlation of duration of reaction with types of cells. In 1943 we demonstrated that 12 hours after the eye of a previously sensitized rabbit is injected with horse serum the cellular infiltration is composed solely of polymorphonuclear

TABLE 4

STATISTICAL COMPARISON OF THE CLINICAL REACTIONS IN THE ANTERIOR OCULAR SEGMENT OF THE UNINJECTED EYES OF EXPERIMENT 1 (FIRST INJECTIONS IN RIGHT EYES) AND OF EXPERIMENT 2 (FIRST INJECTIONS IN SKIN) ON THE DAYS FOLLOWING THE LAST THREE INTRAVENOUS INJECTIONS

	Exp. 1 (Left Eyes)	Exp. 2 (Both Eyes)	Exp. 1 (Left Eyes)	Exp. 2 (Both Eyes)	Exp. 1 (Left Eyes)	Exp. 2 (Both Eyes)
Day of Experiment	30		37		44	
Number of Eyes	15	16	10	10	4	6
Average Reaction	.57	.28	.85	.55	.75	.33
Standard Deviation	.073	.026	.023	.037	.028	.026

rum.^{7, 8} This similarly brings up the possibility of contamination of the horse serum used in my experiments. However, it was received in a sterile condition preserved with merthiolate. It was handled with aseptic technique, and aerobic and anaerobic cultures of samples during the course of the experiment failed to grow any organism. If any surgical contamination occurred, it was in all likelihood so slight that the rabbits' natural defenses were protective. This supposition is supported by the fact that in no instance has a rabbit eye injected with horse serum ever demonstrated any sign of purulent inflammation.

2. CHARACTER OF THE CELLULAR REACTION

The qualitative and quantitative dif-

ferences in the cellular infiltration among the three groups (injected, contralateral, and intracutaneous) seem to depend entirely upon the differences in the severity and duration of the response.

B. The possible role of lipids. Sabin, Doan, and Forkner have shown that lipids from tubercle bacilli act as maturation factors for monocytes or large mononuclear phagocytes, converting them into epithelioid cells and epithelioid cells into

Langhans giant cells.¹⁵ Also, lipid extracts from pyogenic bacteria, such as the colon bacillus, will give rise to epithelioid and giant cells.¹⁶ In the case of horse serum the granulomatous response may be due to the lipid degradation products of horse serum broken down by an antigen-antibody reaction or by tissue lipases. Or it is possible that the response may be due to lipids set free from the uveal tissues themselves.

The presence of lipids in bacteria and in body tissues may explain why similar granulomatous responses have been obtained from a variety of different agents.

3. IS THE CONTRALATERAL RESPONSE RELATED TO AN INCREASED QUANTITY OF HORSE SERUM ENTERING THAT EYE?

The eyes contralateral to those injected developed a significantly greater clinical and microscopic reaction than the eyes of rabbits sensitized by intracutaneous injection. The histopathologic reaction was twice as great. This difference is obvious upon examination of the microscopic slides and was found to be statistically reliable in computation of the probable error of the gradings.

The clinical reaction was also roughly twice as great in the contralateral eyes. In Table 4 the figures for the peak reactions following the last three intravenous injections are given. It can be seen that the average reactions on these specified days are statistically different as far as can be determined in a clinical investigation of this sort.

These results may be explained partially by the work of Guy who found that the following procedures would facilitate the passage of horse serum into the anterior chambers of both eyes: (1) An injection of horse serum into the anterior chamber of one eye. (2) Repeated intravenous injections. (3) Large intravenous injections.¹⁷

In the present experiments, including the preliminary tests, a greater reaction was obtained: (1) When one eye instead of the skin was injected. (2) When two or more intravenous injections were used. (3) When the intravenous doses were large.

These findings parallel and confirm those of Guy. Since he found that such procedures increased the penetration of horse serum into the contralateral eyes, it may be that a greater penetration was the cause of the more pronounced reaction in the uninjected eyes of Experiment 1 as compared to those of Experiment 2. The reasons for this assumed greater penetration were not learned, but there are at least two possibilities which should be considered.

1. A dilatation of the retinal arteries and veins was observed in the contralateral eyes two weeks after the intraocular injection. A similar vasodilatation in the uveal tract might result in an increased transudation of horse serum from the blood stream. In the group sensitized by the intracutaneous route such a retinal vasodilatation was not found prior to the intravenous injections.

2. A second possibility is that the eye is superior to the skin as a site for general sensitization of the rabbit. In a rabbit with a greater degree of general sensitivity, it is possible that transudation of horse serum into an uninjected eye might be increased or that once present its ability to incite a response is enhanced. However, this supposition of greater general sensitivity is not very well substantiated by a comparison of the number of rabbits dying of anaphylaxis in each group. In the first experiment 68 percent, and in the second, 57 percent, died as a result of the intravenous serum. This difference is hardly significant, indicating that roughly the same degree of sensitivity developed in both groups.

4. COMPARISON WITH SOME CLINICAL TYPES OF GRANULOMATOUS UVEITIS

The clinical reactions in the anterior ocular segment were not typically granulomatous in type due mainly to minimal iris involvement and to the presence of an anaphylactic congestive phase. The histologic reaction was more obviously of a granulomatous character and it is this histologic picture which will be compared to some of the clinical types of granulomatous uveitis.

A. Sympathetic ophthalmia. The histopathologic features of the reaction of the rabbit eye to normal horse serum, as compared to the features of sympathetic ophthalmia, were covered in previous reports.^{1,2} The features obtained in those studies were more typical of sympathetic ophthalmia than the ones obtained in this experiment.

With the later enucleations and larger doses used in this experiment, absorption of the infiltrate, fibrosis, and severe retinal necrosis were found in the injected eyes. Another feature of sympathetic ophthalmia has been simulated, however, and that is the production of an appreciable contralateral granulomatous uveitis.

Despite the similarity of the response to sympathetic ophthalmia there are two main points of difference.

1. First and foremost is the distortion, necrosis, and infiltration of the retinas in severely reacting injected eyes.

2. Second is the lesser degree of pigment phagocytosis.

B. Syphilitic uveitis. Except for the absence of perivascular infiltration and obliterating endarteritis, the reaction of the rabbit eye to horse serum bears a resemblance to a syphilitic uveitis. The same types of cells are present; the pigment epithelium is often destroyed; the retina is involved; and the infiltration is followed by organization.

C. Tuberculous uveitis. Characteristic

features of tuberculous uveitis such as nodular infiltration, caseation necrosis, and anterior iris nodules, are not present in the reaction to horse serum, although some of the less distinctive features are seen.

D. Uveitis due to sarcoidosis. The main points of difference are that in sarcoidosis the anterior uvea is usually more affected than the posterior part, and the lesions disappear with little scarring. The main points of similarity lie in the presence of tuberclelike masses of epithelioid cells in injected eyes, and in the absence of caseation necrosis.

SUMMARY

When the right eyes of rabbits were injected with normal horse serum and the rabbits were later given repeated large doses intravenously, a bilateral granulomatous uveitis developed in every case. The reaction was severe in the injected eyes and moderate in the uninjected. The tissue response consisted of an infiltration of the uvea by lymphocytes, large mononuclear phagocytes, plasma cells, and epithelioid cells. The injected eyes developed replacement fibrosis and involvement of the retinas; whereas, the infiltration in the uninjected eyes remained fresh and the retinas were not affected.

A second experiment was done in an attempt to elucidate the mechanism of the contralateral response. The rabbits of this second experiment received an original intracutaneous injection instead of a right intraocular injection but were otherwise treated in the same manner. It was found that both the clinical and microscopic reactions in the uninjected eyes of the first experiment were significantly greater than the reactions in the uninjected eyes of the second. The cause of this apparent superiority of the eye over the skin for the predisposition to a reaction in uninjected eyes was not learned.

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STIMULATION OF CORNEAL EPITHELIZATION WITH TOPICAL APPLICATION OF ERYTHROCYTES*

AN EXPERIMENTAL STUDY

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A variety of chemical and physical agents has been recommended for topical application to stimulate wound repair but, after brief enthusiasm, almost all have been discarded as lacking the healing powers attributed to them. Hence it is with considerable diffidence that a report concerning yet another topical medication is submitted; however, compounds that accelerate the rate of corneal epithelization in experimental animals have been rarely reported and it is possible that local application of erythrocytes may have application in clinical ophthalmology.

Arey¹ in his comprehensive review of factors effecting wound healing mentions the following compounds reported at one time or another as stimulants to cell repair when applied locally. Vitamins A, C, and D, ergosterol and viosterol, testes pulp, thyroid, parathyroid extract, pancreas, insulin, suprarenal gland, anterior pituitary extract, leukocytes, embryonic tissue extract, Witte's peptone, and even irritants such as turpentine. Good results have been claimed for such physical agents as mechanical pressure, infrared, ultraviolet, and roentgen rays, phosphorescent light, and high-frequency electrical current. Hammett's² observation of the stimulating properties of certain compounds containing the sulfhydryl radical prompted reports on the beneficial effect of thiocresol,³ cysteine,⁴ glutathione,⁵ and more recently a proprietary preparation

"sulfhydryl solution."⁶ Šperti⁷ and his associates claim that "wound hormones," namely growth-stimulating substances released by damaged cells, initiate wound regeneration and accelerate healing. Recent well-controlled studies by Smith and Livingston⁸ have indicated a stimulative factor in water-soluble chlorophyll preparations, while Werner⁹ has used a heart extract in a large number of clinical cases with encouraging results. Marshak and Walker¹⁰ have used a chromatin derivative extracted from rat liver to cause increased rates of healing of skin wounds of rats. Schaeffer¹¹ observed an increased rate of epithelization in experimentally abraded corneas treated with a buffered solution containing the amino acids, cysteine, proline, asparagine, and glutamine.

The multiplicity of compounds recommended for acceleration of wound healing indicates the chaotic state of the literature and one must consider with caution the claims advanced by frequently over-enthusiastic investigators. In many of the earlier discussions, conclusions are founded on encouraging responses of the wounds to test agents as contrasted with the effects of medication used previously or after resistance to healing. Agents capable of stimulating tissue growth in culture or in experimental animals may have no similar action when applied locally in man. The cornea presents a singular problem in this regard as results derived from observation of skin healing cannot be applied in toto to corneal epithelization. In skin, wound repair is frequently by fibroblastic proliferation only; while in the cornea, restoration of normal epi-

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thelium is paramount and fibrous tissue formation is highly undesirable.

Moorhead and Unger¹² first employed concentrated human red blood cells as a wound dressing in 1943 and observed beneficial results in burns, infected and noninfected wounds, and certain types of ulceration. They suggested that erythrocytes might serve a useful purpose as a wound dressing in "raw and potentially infected surfaces." Seldon¹³ and his associates found that local application of red blood cells stimulated healing in approximately one half of the cases of chronic ulcers. They recommended its use in ischemic ulcers and those associated with venous stasis. A number of other investigators have confirmed the initial report, but Naide,¹⁴ after using whole blood, discontinued the use of erythrocytes believing that the plasma was more efficacious.

EXPERIMENT 1

This investigation was made to determine the effect of local application of concentrated, washed, human, red blood cells on experimentally produced corneal abrasions.

TECHNIQUE

Freshly drawn citrated, human blood was centrifuged immediately following withdrawal and the supernatant plasma and buffy coat layer containing platelets and leukocytes was removed. The remaining erythrocytes were then washed four times with five times their volume of normal saline to insure removal of all plasma. After removal of the saline and concentration of the erythrocytes by centrifuging, the red blood cell count was 8 to 9 million per cubic millimeter. The test ointment was made by blending 5 cc. of the concentrated erythrocytes in 5 gm. of Hydrosorb ointment (Abbott*). This

* A mixture of the oleic acid ester and the amide of diethanolamine in white petrolatum.

base was selected because of its lack of inhibition on the healing of the cornea as demonstrated by Smelser.¹⁵

Twenty-five immature, male, healthy guinea pigs weighing between 250 and 300 gm. were used. The animals were anesthetized with ether and a local ½-percent pontocaine solution. Using sterile precautions, the epithelium of a central corneal area, 4 mm. in diameter, in each eye was removed with a spatula.

Ointments were instilled in each eye four times daily at 8 A.M., 12 noon, 4 P.M., and 8 P.M. The erythrocyte ointment was used in the right eye, and the ointment base only in the left eye. Prior to the instillation of ointment, one drop of 2-percent fluorescein solution was placed in each eye and the eye was studied in intense illumination with a loupe. Healing was considered complete when the cornea did not stain.

RESULTS

Eight of the 25 animals used were discarded because of corneal infection and were not considered in the final results. Of the remaining animals, the average healing time of the right, treated eye was 36.1 hours with a minimum of 23 hours and a maximum of 44 hours. In the left eye, the average healing time was 48.2 hours with extremes of 28 and 70 hours.

Analysis† of the results indicated that the acceleration of healing in the treated eye was statistically significant. It was concluded that local application of an ointment containing human erythrocytes

† To determine if the difference between the mean healing time of the two eyes was significant or due to chance, the standard deviation of the theoretical distribution of differences between the right and the left eye was determined. It was found that a difference as large as 8.8 hours (3 standard errors of the difference between the two means) might arise due to chance. In that the observed difference was 12.1 hours, it was concluded that the results were significant.

stimulated corneal epithelization in the guinea pig.

The method by which red blood cells exert this action is not known, but the complex physical and chemical structure of the erythrocyte and the unique metabolism of the cornea gives basis for wide speculation. Many of the compounds reported to stimulate healing of skin wounds are present in the erythrocyte. Thus, all of the glutathione in blood is present in the red blood cell and Kendall¹⁶ was of the opinion that some chemical factor, possibly glutathione, was responsible for the effect. However, glutathione in 5-percent concentration in an ointment base does not stimulate corneal regeneration following abrasion in the guinea pig.¹⁷

Globin and ghost cells contain all of the essential amino acids and Murray and Shaar¹⁸ suggested, on the basis of their clinical investigation, that erythrocytes might supply nutritional elements, possibly deficient because of inadequate circulation. They also suggested that the crust of erythrocytes served as a mechanical scaffolding to support epithelization. Heme, the iron prosthetic group of hemoglobin, is a ferriprophoryn chemically related to chlorophyll and other porphoryns which have been reported to accelerate healing. All of the amino acids used by Schaeffer¹¹ to accelerate corneal epithelization are present in the red blood cell but as polypeptides and proteins and presumably not available for use as such.

Baker¹⁹ found that hemoglobin added to a mixture of liver ash and glutathione caused rapid proliferation of fibroblasts in vitro. She attributed this result to regulation of the oxidation-reduction reactions and respiration within the cells of the culture, and it is considered possible that a similar mechanism is responsible for acceleration of corneal healing activities.

Several investigators have attributed the healing action of erythrocytes, as observed in the treatment of stasis ulcers, to mechanical protection only. In that each eye in these experiments had comparable protection from the ointment base, it is concluded that such a factor is not responsible for acceleration of corneal epithelization in the eye. Carrell²⁰ showed that mild irritation of a wound initiated tissue regeneration while in the absence of chemical, mechanical, or bacterial irritation, healing was markedly delayed. However, sufficient irritation is ordinarily present in ocular wounds to initiate tissue regeneration and this mechanism seems highly improbable.

EXPERIMENT 2

To determine if a particular portion of the erythrocyte was responsible for the stimulation, an investigation was made using the primary products of mechanical and chemical fractionation of the erythrocyte; that is ghost cells, globin, heme, and hemoglobin.

TECHNIQUE

Whole citrated blood, 10 to 15 days old, obtained from the Wesley Memorial Hospital Blood Bank, was used in all procedures. All manipulations, including centrifuging, were carried out at a temperature of 2°C., except as noted. The erythrocytes were separated from the plasma and washed five times with normal saline and refrigerated until used.

Ghost cells, the cell envelopes of the red blood cell with the hemoglobin removed, were obtained by adding to the washed erythrocytes five times their volume of water, saturated with carbon dioxide at 2°C. This hemolyzed and flocculated the cells which were then removed from the solution by centrifuging. The ghost cells were washed repeatedly with

cold, carbonated water until they assumed a light, pinkish color and the supernatant fluid was colorless. An ointment was made by blending 5 cc. of the concentrated ghost cells with 5 gm. of hydrosorb ointment.

Oxyhemoglobin was prepared by the method of Marshall and Welker,²¹ first laking the washed erythrocytes with distilled water, mixing with freshly prepared alumina cream, and filtering in the refrigerator. The solution was sterilized by passage through a Berkefeld filter, and a test ointment was made by adding 5 cc. of the oxyhemoglobin solution to 3 gm. of ointment.

Globin and heme were prepared by the method of Anson and Mirsky.²² Oxyhemoglobin was prepared as above and cold, distilled water added to 10 percent of its volume. To this solution was added an equal volume of 0.1 N. hydrochloric acid. The globin was precipitated by adding 20 times the volume of acid acetone and then separated from solution by filtration and dried in air. The globin was dissolved in distilled water, sterilized by passage through a Berkefeld filter, and an ointment prepared of equal parts saturated globin solution and hydrosorb.

Heme was precipitated from the acid acetone filtrate by acidifying with sodium acetate. It was then separated from solution by filtration. It was dissolved in bicarbonate buffer (pH = 10.1), sterilized, and blended into an equal amount of hydrosorb.

Five male, albino rabbits weighing between 2 and 3 kilograms each were used to test each ointment. Following ether anesthesia, the corneal epithelium of each eye was removed with dry gauze, and the eyes were stained with fluorescein to assure equal removal. Ointments were instilled four times daily, the test ointment in the right eye and the ointment base

only in the left eye. Each cornea was stained with fluorescein prior to each installation of ointment, and the eye was studied in intense illumination with a loupe.

RESULTS

Healing time in the treated and untreated eyes was between 4 and 6 days with no significant difference in the rate of healing of the eyes treated with ointments containing respectively globin, heme, oxyhemoglobin, and ghost cells, and the control eyes.

The failure of these erythrocyte products to accelerate healing may be explained in a number of ways. The initial possibility was that the stored blood used to prepare these products had lost some factor present in freshly drawn blood which was responsible for acceleration of wound healing. It was possible, however, to accelerate corneal regeneration using stored erythrocytes which indicated that living cells were not essential.

It seems most likely that the substance or substances responsible for the stimulation of healing were so modified in the separation process as to lose this power or were entirely removed and not represented in the final product. On the basis of these experiments, it seems probable that the proteins of globin and ghost cells are not responsible for stimulation of healing, and that the porphyrin radical of heme has no such action. Not disproved is the possibility of a synergistic mechanism whereby these substances exert a stimulative action when combined and not when separated.

Certain of the compounds removed in fractionation of the erythrocyte may be responsible for the acceleration of wound healing. Caspe²³ suggested that allantoin is responsible, but this compound seems more likely an end product of metabolism

rather than possessing metabolic activity. The erythrocyte contains a relatively large amount of adenosine triphosphate which may furnish the high energy phosphate bonds necessary for increased corneal metabolism accompanying acceleration of healing. The potassium ion in the red blood cell could catalyze such an action. Coenzyme II which is present in significant amounts in the blood cell may catalyze the above action or one of several others all of which would increase corneal metabolism.

SUMMARY

Treatment of experimentally abraded corneas with an ointment containing washed, packed, human, red blood cells resulted in significantly increased rates of epithelization in the guinea pig.

Treatment with ointments containing ghost cells, heme, globin, and oxyhemoglobin, respectively, did not cause acceleration of corneal epithelization.

Possible mechanisms of this action are discussed.

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DISCUSSION

DR. JONAS FRIEDENWALD (Baltimore, Maryland): I would like to ask what was the healing in eyes that were not treated at all, with any ointment. The question is asked because practically every ointment used in the eye delays healing to some extent, and I am wondering whether the favorable effect of the inclusion of red

blood cells in the ointment might merely be neutralizing the inhibition of the ointment.

DR. FRANK W. NEWELL (Chicago, Illinois): I have not conducted experiments on eyes treated without ointments. I am afraid that I am not able to answer that question.

THE EFFECT OF DI-ISOPROPYL FLUOROPHOSPHATE ON THE CAPILLARIES OF THE ANTERIOR SEGMENT OF THE EYE IN RABBITS*

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New York

The instillation of a 0.2-percent solution of di-isopropyl fluorophosphate into the conjunctival sac is usually followed in rabbits by a pronounced rise of ocular tension accompanied by edema of the ciliary processes and the formation of plasmod aqueous. These changes indicate increased capillary permeability correlated with elevation of intraocular pressure. In the present study on the mechanics of this transient experimental glaucoma, the functional alterations of blood capillaries in respect to permeability[†] were investigated, as well as the prevention of these alterations by several groups of drugs. The occasional rise of tension in human eyes after topical use of D.F.P.[‡] and especially the similarity of the test lesion to the human permeability glaucoma, added interest to the subject. Several aspects of the problem were examined using the rabbit as the experimental animal.

* Supported by the Knapp Memorial Foundation. From the Department of Ophthalmology, College of Physicians and Surgeons, Columbia University, and the Institute of Ophthalmology, Presbyterian Hospital. Read in part at the 16th scientific meeting of the Association for Research in Ophthalmology, Inc., at Atlantic City, June 10, 1947.

† The term capillary permeability is used in the present study irrespective of whether the changes in the rate of diffusion across the capillary wall were the result of altered pore size in the intercellular cement or of increase in filtration pressure.

‡ In a group of 50 glaucoma patients observed in the Institute of Ophthalmology, Presbyterian Hospital, five eyes with primary glaucoma responded to the use of D.F.P. with an increase instead of with the expected decrease in intraocular pressure. Leopold and Comroe¹ and McDonald² have previously reported a smaller incidence of such a reaction in a much larger series of glaucomatous eyes treated with D.F.P.

EXPERIMENTAL PROCEDURES

The rise of ocular tension, the protein content in the aqueous, and the depth of the anterior chamber after the local use of D.F.P.

The histologic appearance of the anterior segment of the eye under the influence of D.F.P. as described by R. O. Scholz³ was confirmed in the present experiments. The changes consisted of swelling of the ciliary processes, development of Greeff blebs and appearance of a protein coagulate in the posterior and anterior chamber with some coating by proteins in the angle meshwork. They were especially striking when the eyes with heightened intraocular pressure after D.F.P. administration were compared to the untreated control eyes. Therefore, the relationship between protein content in the aqueous and the rise in tension was studied first.

TECHNIQUE

After tonometric determination of the ocular tension, 2 drops of an 0.2-percent solution of D.F.P. in peanut oil were deposited three times, three minutes apart, in the right eyes of adult chinchilla or albino rabbits. The changes in tension were recorded over periods of time from $\frac{1}{2}$ to 5 hours and sometimes up to 24 hours. Many experiments were terminated after one hour by withdrawal of aqueous from the treated and the control eyes for protein determination by the Looney-Walsh method adapted for 0.1 cc. of aqueous as previously described.^{4, 5} In a small number of experiments, the measuring of protein content was omitted.

These eyes were quickly frozen and cut in the vertical meridian and the depth of the anterior chamber in treated and control eyes was measured with a caliper under a 3 \times loupe magnification.

RESULTS

The rise in tension became obvious 30 minutes after the instillation of D.F.P. and increased during the following hour; the tension then fell, but usually remained elevated for 4 to 6 hours. The degree of ocular hypertension varied greatly in individual animals. The maximum tonometer readings generally ranged between 30 and 50 mm. Hg, but measurements from

an average protein level of 40 to 50 mg. percent which is on the high side of the range considered normal for rabbits.

The depth of the anterior chamber between the posterior surface of the cornea and the anterior pole of the lens was between 2½ and 3½ mm. depending on the size of the eye or the age of the rabbit. No clear or constant difference in depth was noted between eyes with high tension and untreated control eyes.

COMMENT

The data presented show that the connection between the increase in tension and protein concentration in the aqueous

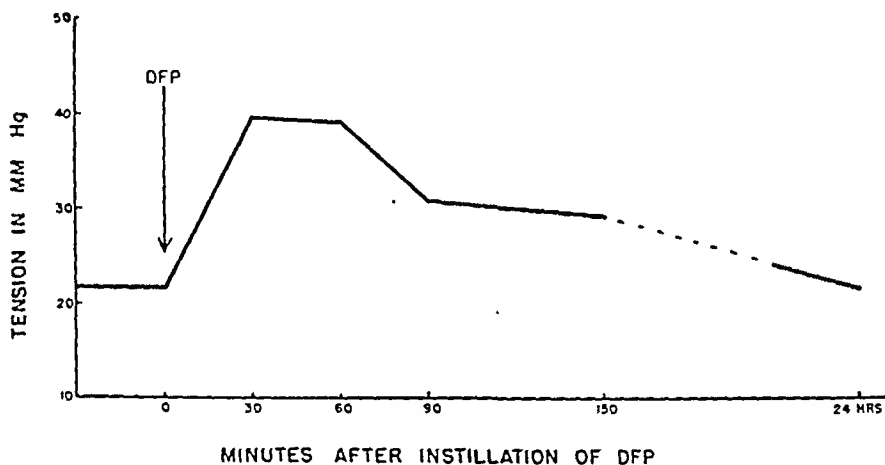


Fig. 1 (von Sallmann and Dillon). Changes in ocular tension after instillation of 0.2-percent solution of D.F.P. into conjunctival sac of rabbits.

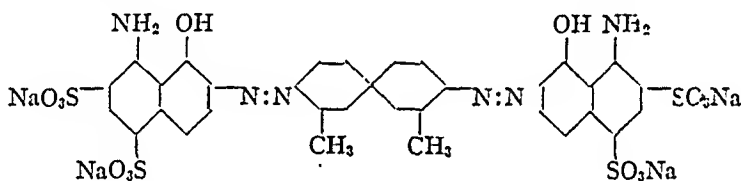
25 to 30 mm. and from 50 to 60 mm. Hg were also seen. The curve of Figure 1 illustrates the course of the tension changes based on 152 readings. The protein content in the aqueous was in general lower in eyes with moderate elevation of intraocular pressure and higher in eyes with greater hypertension, but the protein readings varied greatly in eyes with similar tension values. The protein concentration ranged, for example, from 200 to 1,450 mg. percent in the group having tension values of 40 to 60 mm. Hg. The aqueous of the control eyes showed

was slight, although there was a general indication that higher protein values were found more frequently in eyes with steeper and higher rises in ocular pressure. Recalling the marked edematous swelling of the ciliary processes with the development of Greeff blebs, one might conclude that the absolute height of the ocular tension was connected with filtration of water from the circulating blood into the extracellular tissue of the processes and into the chambers of the anterior part of the eye rather than with the passage of proteins.

The location of the swollen ciliary processes in rabbits between the peripheral part of the anterior surface of the lens and the posterior surface of the iris could conceivably influence the depth of the anterior chamber and the ocular tension in various ways. Although the accuracy of the measurements on frozen eyes compares unfavorably with the photographic method devised by Friedenwald and Pierce, and others,^{6a,b,c} any major difference in depth between eyes with high tension and the control eyes could not have been overlooked.

Capillary permeability in the anterior segment of eyes after local use of D.F.P. studied with the blue Azo Dye T-1824.

The vital dye T-1824 with the supposed structural formula



was first recommended by Dawson, Evans, and Whipple,⁷ for blood-volume determination. Gregersen, Gibson, and Stead,⁸ using this dye, developed the method of measuring blood and plasma volume now widely employed. T-1824 in plasma or normal saline does not diffuse through cellophane membranes,⁹ and does not pass the choroid plexus.¹⁰ Its relatively low toxicity¹⁰⁻¹³ and its slow removal from the blood, observed by all investigators in this field, made the dye suitable also for studies of general capillary permeability in shock, and for changes of permeability in circumscribed areas. Such investigations were conducted by means of moat chambers in rabbit ears;¹² the increase of capillary permeability in experimental and human malignant neoplasms was in part established by the use of T-1824.^{15, 11} Greger-

sen and Rawson¹⁶ supplied highly suggestive evidence that, after intravenous injection, the dye becomes firmly bound to the serum albumin and that it escapes from general circulation in linkage with albumin. It appears to Gregersen and Rawson that this binding "is essentially equivalent to a tagging of albumin." The reasons for this assumption will be outlined in the discussion. On this basis, it was felt in the present study with T-1824 that permeability of capillaries in the anterior segment for protein was examined rather than permeability for a colloidal dye.

TECHNIQUE

Thirty minutes after the repeated instillation of a 0.2-percent solution of D.F.P. in one eye of albino rabbits, the

dye, dissolved, prepared, and autoclaved according to usual rules, was injected in one of the lateral ear veins in a dose of 20 mg. per kilogram. The permeation of the colored substance from circulating blood into the tissue and fluids of the anterior part of the eye was observed by transscleral transillumination and biomicroscopically. For permanent recording, a great number of Kodachromes were taken of various stages of permeation of the dye in eyes treated with D.F.P. and in the control eyes. At the end of the observation period, the tension was measured, the aqueous withdrawn for protein determination, and the eyes dissected to allow direct inspection of the ciliary processes. Their staining in the treated and control eyes was also photographed in color. Finally the iris and ciliary body were removed,

fixed in acetone, embedded in paraffin, sectioned, and studied microscopically without additional staining.

In a group of three animals, the cytochrome oxydase of the ciliary epithelium was inhibited by cyanide iontophoresis in one eye with the technique previously reported.¹⁷ The D.F.P. solution was instilled in both eyes 20 minutes later. This procedure was followed after 20 minutes by intravenous injection of the dye. The changes in the caliber of the vessels and the appearance of the dye compound in the anterior portion of the eye was observed in the usual way.

Three albino rabbits serving as controls were injected in the same manner with T-1824 without preceding treatment with D.F.P. or tonometric measurements. The animals were killed after one hour by intravenous injection of a 2-percent solution of sodium pentobarbital, then the eyes were removed without exerting undue pressure and were dissected in a frontal plane about 3 mm. behind the limbus. The vitreous and lens were gently removed and the posterior surface of the ciliary body and the iris were exposed for examination with the loupe or wide-angle microscope and for color photography.

RESULTS

In control animals, no trace of dye was seen outside the vessels of the limbus and iris when examined with strong light and loupe magnification or under the 30X enlargement of the corneal microscope. There was a light blue coloration of some ciliary processes, which indicated slight permeability of ciliary capillaries for the dye-protein complex in untreated eyes. Staining of several ciliary processes was somewhat more marked in the eyes of a young animal weighing less than 2 kg. No dye was seen in the primary aqueous.

Similar results were observed in the

control eyes of rabbits receiving D.F.P. treatment on the contralateral eyes; that is, no dye passed through the walls of the limbus and iris vessels into the tissue. However, many ciliary processes showed a light-blue staining which did not extend into the tissue of the iris. The aqueous was apparently free of dye.

The eyes on which D.F.P. had been

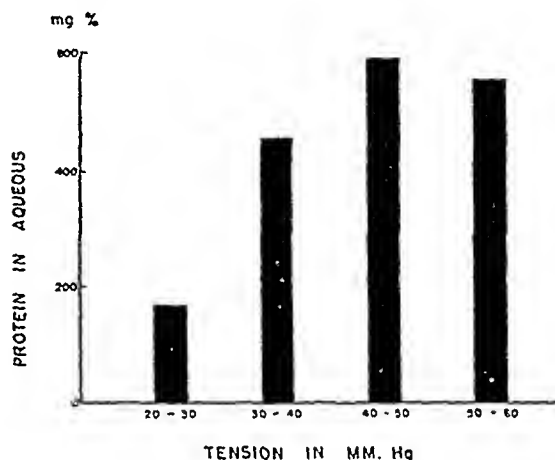


Fig. 2 (von Sallmann and Dillon). Protein content in aqueous and ocular tension one hour after instillation of D.F.P. in rabbits.

used prior to the injection of the dye had dilated limbal vessels and distended iris capillaries, mostly in the pupillary part, but no permeation of the colored substance through the walls of these dilated vessels occurred. On the other hand, under transscleral transillumination, a progressively more intense staining of the ciliary processes became visible, followed within five minutes by the appearance of blue lines in the iris. They were not related to the vessels of the iris, but clearly signified the spreading of the colored material from the ciliary processes along their insertions at the posterior surface of the iris. The blue lines later lost their sharpness as the dye complex diffused into the iris tissue and escaped from its anterior surface into the aqueous. At a later stage, a dark-blue stained aqueous emerged from the posterior chamber

through the pupil into the anterior chamber. All these changes could be seen macroscopically and were well demonstrated by color films.

The inner surface of the ciliary body and of the iris showed a homogeneous deep-blue ring corresponding to the corona ciliaris. The accumulation of dye in the processes outside the vessels was so abundant that no attempt was made to examine for a gradient of vascular permeability along the arterioles, capillaries, and venules in the sense of Rous and Smith.¹⁸

The primary aqueous of the eyes which had been instilled with D.F.P. showed a light blue color about 30 minutes after the injection of the dye. The intensity of the dye could not be estimated either by the common slitlamp technique or with the addition of filters. It could only be estimated on withdrawn samples, and in these the concentration of dye and protein in the aqueous seemed roughly proportional. Spectrophotometric measurements of the optical density values in the small amount of aqueous available (0.1 cc. was used in protein measurements) were not attempted in this study.

Several phases of the diffusion of T-1824 from circulating blood into the tissue of the ciliary processes could be distinguished microscopically on unstained sections. First the interstices of the ciliary processes appeared homogeneously tinted, occasionally with a moderately more intensive staining of the vascular wall. Thirty minutes after injection, the colored material was seen in many processes in the form of blue bands underneath the covering layers of epithelium. In several instances, the dye was later visible within the epithelial layers. There was no evidence, however, that the dye had entered the cytoplasm of the cells. Two hours after the injection, a few histiocytes in the processes contained blue

granules. Later stages were not examined.

The diffusion of the dye into the structures of the ciliary processes and iris and into the aqueous occurred in the same way in eyes which had been treated with cyanide iontophoresis and D.F.P. instillations as in eyes in which D.F.P. had been used alone. The banking of the colored substance underneath the epithelial layers was also similar to that of the control eyes. As far as can be judged from fixed preparations, the inhibition of the indophenol oxydase in the ciliary epithelium apparently did not change the permeation of the dye from the blood into the tissues and chambers of the anterior part of the eye.

COMMENT

Gregersen and Rawson¹⁶ explained the slow escape of T-1824 from the blood, which greatly exceeded the disappearance rate of structurally related diazo dyes by its combining with proteins. The nature of the linkage is not known. Rawson and Moore¹⁹ showed in electrophoresis experiments that the dye was wholly bound by the albumin fraction of the serum up to a molar concentration of 10:1; that is, 1 mole albumin may combine with as many as 10 moles of T-1824. The affinity to albumin markedly surpassed that of trypan blue and niagara sky blue as concluded from the results of Rawson's celophane staining test. No dissociation of the dye-albumin compound occurred in the electrophoretic cell or in ultracentrifugation where the dye came down with the albumin.

In general the histologic examination of the ciliary processes of albino rabbits did not reveal, in the early phases, a preferential binding to constituents of the plasma membrane, the cytoplasm of cells, or other tissue elements. The appearance of protein and dye in the Greeff blebs and

the roughly proportional content of dye and protein in the aqueous strengthened the impression that a splitting of dye from protein did not occur during the permeation from the blood through the membranes of the blood-aqueous barrier, and that the dye-albumin complex passed into the aqueous as a whole. From the already mentioned binding capacity of albumin, it can be seen that the amount of dye injected fell far below this value.

In normal undisturbed rabbits' eyes, a small amount of the colored material entered from the blood into the tissue of a few processes. In view of the relatively low toxicity of the dye this would indicate that the ciliary capillaries of rabbits possess a moderate degree of protein permeability. It is known that the physiologic impermeability of the capillary wall to protein is not uniform in various areas of the peripheral circulatory system, and it has been shown with other colloidal dyes that under pathologic conditions the capillaries of the ciliary processes are more permeable than the capillaries of the iris. Such a gradient of permeability between limbus and iris and ciliary capillaries could be observed in the present study in the untreated eye, but much more convincingly by dilating the vessels of these three systems in the anterior portion of the eye by means of the anticholinesterase D.F.P. The retention of the dye complex by the wall of the limbus and iris capillaries was not changed in the state of dilation. It is interesting that Rocha e Silva and Dragstedt²⁰ and others could not produce a positive trypan blue reaction by injecting acetylcholine intradermally in an abdominal area of rabbits. Similarly, Last and Loew²¹ did not observe increased capillary permeability tested with this method in the rabbits' skin by substituting the longer acting acetyl-methylcholine for acetylcholine.

The blue color of the dye T-1824 which

proved beneficial in measurements of blood volume was also of advantage in the study on eyes of albino rabbits. Certain difficulties in the interpretation of experiments with fluorescein were eliminated by the use of T-1824, as its initial diffusion from the circulating blood into the loose tissue of the ciliary processes, its spreading into the iris, the escape from the iris surface into the aqueous, and the outpouring of dark blue aqueous from the posterior chamber through the pupil could be readily demonstrated.

The local action of D.F.P. on the vessels of the limbus.

The dilation of the vessels in the anterior part of the eye and the pronounced increase in permeability of the ciliary vessels to protein was supposedly elicited in the present experiments by the intensified action of the undestroyed cholinergic chemical mediator. It was not clear how this effect was brought about or where the point of attack lay. To our knowledge, no work on the pharmacology of D.F.P. has been reported in regard to its local action on vessels. On the other hand, the innervation of finer branches and the intimate anatomy of the functional unit of the capillary bed—capillary-metarteriole-venule—in the anterior portion of the eye, has not been studied sufficiently. Observations of the limbus vessels under a 30-fold magnification of the corneal microscope supplied several suggestive data on the local action of D.F.P.

TECHNIQUE

In an area of the limbus of one eye of albino or chinchilla rabbits which could be well exposed under the corneal microscope, the distribution and relative calibration of small arterioles, capillaries, and veins were outlined in a sketch. Then a 0.2-percent solution of D.F.P. was instilled into the conjunctival sac and the

sequence of caliber changes of various parts of the vascular net was registered. After 15 minutes, the minimal effective dose of epinephrine for closure of capillaries was determined on the eye which had received the D.F.P. drops as well as on the contralateral control eye. The caliber changes of the vessels in the selected area of the limbus were again outlined and compared to those observed after the use of D.F.P. Photographic records could not be obtained.

RESULTS

The dilation of the limbus vessels was noted within 10 minutes after several drops of the D.F.P. solution had been employed. The diameter of arterioles, metarterioles, and capillaries increased about the same time. No premature distention of capillaries preceding the hyperemia of arterioles was seen. Under the conditions of the experiments, it could not be decided whether the region of the precapillary sphincter itself responded synchronously with the arterioles.

The concentration of the minimal dose of epinephrine hydrochloride necessary for marked constriction of the vascular tree and closure of some capillaries was 1:500,000 to 1:1,000,000, when several drops of this solution had been deposited in the conjunctival sac. This dose had to be increased 20 to 100 times, that is to about 1:10,000 for a comparable constriction of the terminal branches of the limbus vessels of eyes under the influence of D.F.P. The narrowing of the capillaries took place simultaneously with the great reduction in the size of the diameters of the arterioles and metarterioles.

COMMENT

In general, the technique of Chambers and Zweifach²³ and Zweifach²² devised for the mesentery capillaries of rats was

applied in the epinephrine experiments. The magnification which these authors could utilize for their examination of the vessels in the meso-appendix was at least three times greater and the conditions for accurate observations were by far more favorable than those in the experiments on the limbus vessels of rabbits. Here it was impossible to identify structural details such as the location of Tannenberg's²⁴ "Pfoertner Zellen" or the precapillary sphincter, and to judge the sensitivity of this area to effective threshold concentrations of epinephrine in comparison with the sensitivity of arterioles or metarterioles.

Capillaries and arterioles changed in caliber at about the same time both in dilation after use of D.F.P. and in constriction induced by subsequent instillation of epinephrine hydrochloride (1:10,000). These results suggest that accumulated acetylcholine acted on the neuromuscular junction of the arterioles and that the induced dilation of these branches with its augmented blood flow led immediately to a passive filling of the capillaries. This concept is in line with the widely accepted opinion^{22, 25, 26} that the filling of mammalian capillaries and venules follows passively the dilation and contraction of the supplying arterioles.

The influence of drugs on the increased capillary permeability induced by the use of D.F.P.

The signs of increased capillary permeability including elevation of intraocular pressure in the test lesion could be variously influenced by drugs. In these experiments changes in tension, in protein content of the aqueous, in diffusion of the dye T-1824, and in size of the pupil were observed and correlated. Four groups of pharmaceuticals were examined: (1) adrenergic compounds, (2) pituitrin (3)

a calcium salt and adrenal cortex extract, and (4) histamine antagonists. The measurements of protein content in the aqueous and the use of the dye followed the technique previously described. Variations in timing of the experiments and in application of the drug will be dealt with separately in the individual sections.

1. ADRENERGIC DRUGS

TECHNIQUE

Epinephrine and neosynephrin were tested. Epinephrine hydrochloride, 0.1 cc. of a solution (1:1,000), was injected subconjunctivally underneath the superior rectus muscle of the right eye 20 minutes

RESULTS

The subconjunctival injection of epinephrine hydrochloride on the right eye prior to treatment of both eyes with D.F.P. prevented the rise in tension of this eye. The differences of the tension values between the two eyes were consistently greater 30 minutes after the last instillation of D.F.P. drops. At this time the averages of 10 experiments were 18.3 mm. Hg, right eye, and 43.5 mm. Hg, left eye. Ninety minutes after the use of D.F.P. the respective values of seven experiments read: 16.7 and 25.9 mm. Hg, and in the three eyes which were measured 150 minutes after employment of

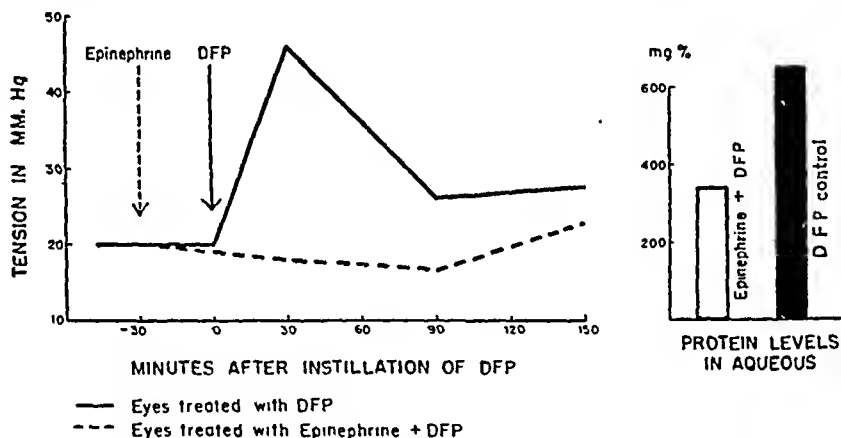


Fig. 3 (von Sallmann and Dillon). Changes in ocular tension and protein levels in the aqueous after instillation of D.F.P. preceded by subconjunctival injection of epinephrine hydrochloride (0.1 cc. 1:1,000 dilution) in one eye.

prior to repeated instillations of the solution of D.F.P. in both eyes. One drop of the emulsion of neosynephrin hydrochloride, 10 percent, was deposited three times in the right eye 30 minutes before or 10 minutes after the use of the D.F.P. solution in both eyes. In the experiments in which the use of neosynephrin preceded that of D.F.P., three drops of the blank vehicle were applied in the left eye. The measurements of the pupillary diameters were made with a pencil flashlight at a distance of one foot.

D.F.P., 22 and 29.3 mm. Hg. The protein readings in the aqueous of six rabbits at the 90-minute interval showed averages of 354.4 mg. percent, right eye, and of 643.7 mg. percent, left eye. In the albino rabbits, which had received the dye T-1824 intravenously with the usual technique, the right iris remained unstained. After dissection of the eyes, the right ciliary processes were considerably less blue than in the control eyes and were often unstained in the upper medial sector corresponding to the area of in-

jection. Thirty minutes after the use of D.F.P., the diameter of the right pupil measured from 3.5 to 5 mm. while the average diameter was 1 to 2 mm. in the control eyes.

Neosynephrin-hydrochloride emulsion applied to the right eye before the use

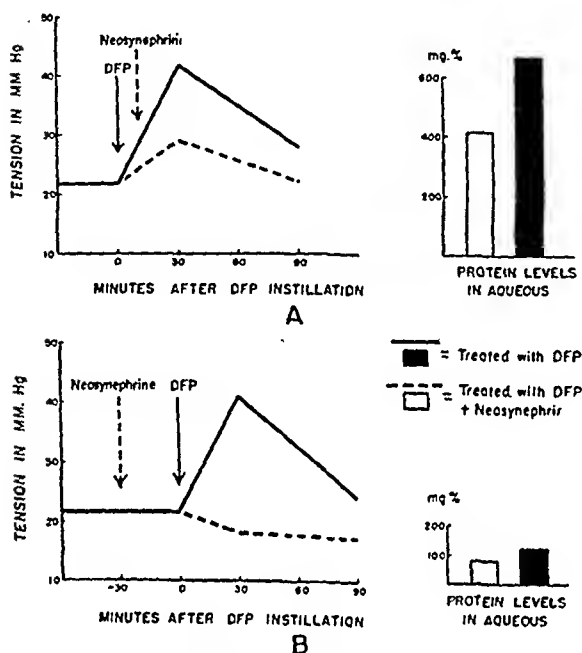


Fig. 4 (von Sallmann and Dillon). Changes in ocular tension and protein levels in the aqueous after the instillation of D.F.P. (A) followed by instillation of neosynephrin-hydrochloride emulsion (10 percent); (B) preceded by neosynephrin-hydrochloride emulsion (10 percent).

of D.F.P. counteracted the effect of D.F.P. on the intraocular pressure. The tension values after 30 minutes were: R.E., 17.5 mm. Hg, and L.E., 42.3 mm.; and after 90 minutes: R.E., 17 mm. Hg, and L.E., 24 mm. (average of four experiments).

The protein in the aqueous measured less than 80 mg. percent in the right eye and 111 mg. percent in the left. The aqueous of the eyes treated with neosynephrin was not colored and the ciliary processes were stained only light blue. The size of the pupil differed less from

the size in the control eyes (3 to 4 mm.: 1 to 2 mm.) than in the epinephrine experiments.

The instillation of neosynephrin 10 minutes after the use of D.F.P. influenced the tension to the following extent—after 30 minutes: R.E., 29.3 mm. Hg; L.E., 41.8 mm.; after 90 minutes: R.E., 22.5 mm. Hg; L.E., 27.5 mm. (average of four experiments). The protein measurements in the aqueous gave an average of 337 mg. percent in the right eye and 532 mg. percent in the left. This series did not contain tests with T-1824. The relation of the pupillary diameters of both eyes was comparable to that in the preceding experimental group.

COMMENT

It is obvious that the two adrenergic compounds eliminated the elevation in tension, occurring in rabbits after the use of D.F.P., when they were administered prior to or after the instillation of D.F.P.

The curve of rising tension in the control eye did not deviate from the average standard curve (fig. 1) at the 30 minute interval, but declined rapidly thereafter, so that values below 30 mm. Hg were reached after 90 minutes. This early decline of the tension curve suggested absorption of the sympathomimetic compound from the conjunctival sac of the treated right eye into the general circulation, affecting the other eye. The comparatively small difference between the protein reading in the aqueous of both eyes (especially in the experiments with neosynephrin—first group) can also be interpreted in the same way. The results of the dye experiments did not contribute to answering this question since quantitative measurements of the optical density in the aqueous were not carried out.

The use of epinephrine or neosynephrin greatly interfered with the con-

striction of the pupil due to D.F.P. The dilation of the pupil in this combined treatment must be considered a hazard already experienced in a few instances of human chronic glaucoma with high tension, which did not respond favorably to local medication with D.F.P. The addition of epinephrine base, dissolved in oil, led to a further widening of the pupil and subsequent rise in tension.

Thirty minutes later the tension was recorded, and the D.F.P. solution was instilled in one eye in the experiments with systemic injection or in both eyes of rabbits which had received the topical treatment unilaterally.

RESULTS

Intramuscular injection of pituitrin caused a drop in tension of untreated

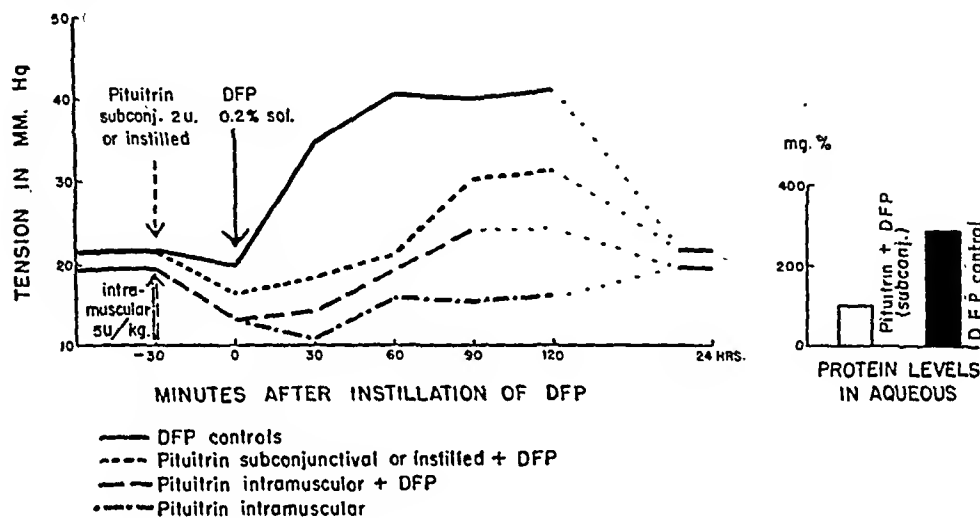


Fig. 5 (von Sallmann and Dillon). Changes in ocular tension and protein levels in the aqueous after the instillation of D.F.P. preceded by instillation, subconjunctival or intramuscular injection of pituitrin.

2. PITUITRIN

The effect of posterior pituitary preparations was studied with the Parke Davis product, which contains 20 international units per cc. The drug was administered by the systemic route or topically on untreated eyes and on eyes under the influence of D.F.P.

TECHNIQUE

The tension was taken prior to any medication. The pituitrin preparation was injected intramuscularly in a dose of 5 units/kg. or under the conjunctiva in one eye in a dose of 2 units. In a few instances the solution was instilled into the conjunctival sac instead of being injected.

eyes from 19.3 mm. Hg to 10.5 mm. after one hour and to 15.5 mm. after 150 minutes (averages of six experiments). It overcompensated the effect of D.F.P. for one hour with average readings of 14 mm. Hg, rising to 24 mm. after two hours.

The initial tension of 21.8 (six experiments) decreased to 16.3 mm. Hg, 30 minutes after the subconjunctival injection of 2 units; the tension of the other eye was not changed at this time. In 18 eyes with an average initial tension of 19.5 mm. Hg, the heightening of tension after use of D.F.P. was eliminated for 90 minutes (average readings after 30 minutes 18.3 mm. Hg and after 90 minutes 20.8 mm.). In these experiments

with the topical use of pituitrin the measurements of the protein content in the aqueous revealed a ratio of 66.7 to 283.3 mg. percent (average of four experiments) for the eyes treated with pituitrin and D.F.P. and the eyes treated with D.F.P. respectively. The instillation of the pituitrin gave results like those obtained with the local injection.

In the dye experiments the difference in the intensity of staining of aqueous, iris, and the ciliary processes between the two groups of eyes was very marked; that is, the aqueous was unstained, the iris showed no escape of the dye, and the ciliary processes were tinted much less than those of the control eyes, especially in the upper medial sector. When the anterior chamber of both eyes was emptied 150 minutes after the injection of pituitrin in the right eye, the secondary aqueous was almost unstained in contrast to the very dark-blue colored aqueous which filled the anterior chamber of the left eye.

The subconjunctival injection of pituitrin prevented the maximal constriction of the pupil observed after use of D.F.P., but the difference between the two eyes was markedly less (2-3 mm.: 1.5-2 mm.) than in the experiments with epinephrine or neosynephrin.

COMMENT

The systemic and local uses of pituitrin were beneficial in blocking the action of D.F.P. on the tension of rabbits' eyes. The protein readings in the aqueous and the observations with the dye indicated that the prevention of ocular hypertension was connected with the vasoconstricting effect of the hormone which lasted several hours as shown best in the formation of an almost colorless secondary aqueous 150 minutes after the local use of pituitrin. The comparison of the protein concentrations in the aqueous and of the changes in ocular pressure of the

eyes treated with pituitrin and D.F.P. with those treated with D.F.P. alone pointed again to systemic absorption of the hormone from the depot beneath the conjunctiva. This assumption explained the difference of values in control eyes of this series from averages obtained in rabbits on which only D.F.P. was used. It might be of practical importance that the topical use of pituitrin secured the full effect on the permeability of the ciliary capillaries with only moderate inhibition of the D.F.P. miosis.

3. CALCIUM. ADRENAL CORTICAL EXTRACT

It has been stated that any procedure which alters the physicochemical properties of the intercellular cement affects the rate of filtration across the capillary wall. Chambers and Zweifach²³ demonstrated with an elaborate technique that calcium-free perfusion fluid at a slightly acid pH rendered the capillary wall leaky by softening and washing away the intercellular cement, and that doubling the normal amount of calcium in the fluid caused overproduction of the cement material. This experimental evidence concerning the importance of the calcium concentration in the perfusate for the filtration across the capillary wall was the basis for investigations on the effect of a calcium salt variously introduced in eyes in which protein permeability of the ciliary capillaries had been increased by instilling D.F.P. solution in the conjunctival sac.

The use of adrenal cortical extract was considered in view of the studies of Swingle, Parkins, and Remington,²⁷ Menkin,²⁸ Freed and Lindner,²⁹ and others, in which the integrity of the peripheral vascular system and the maintenance of normal capillary permeability was shown to be controlled in some way by the adrenal cortex. There is no experimental evidence that the extract influences capillary permeability by changing physical condi-

tions of the intercellular cement, but the possibility of such a mechanism cannot be ruled out.

TECHNIQUE

A. Calcium. Calcium gluconate, 10 percent (pH 5.5),* was either injected under the conjunctiva (0.2 cc.), introduced by anode corneal iontophoresis (1.5 ma. for 5 minutes), or given intravenously (5 cc. per kg.). D.F.P. instillations on both eyes followed the local procedures after 30 minutes and preceded the systemic introduction by 10 minutes.

RESULTS

The subconjunctival use of calcium salt on the right eye caused severe chemosis and did not noticeably alter the rise in tension after use of D.F.P. (average of four experiments: R.E., 56 mm. Hg; L.E., 60 mm.). When calcium iontophoresis was employed on the right eye 30 minutes before depositing D.F.P. drops in both eyes, tension curves of both eyes reached almost the same levels one hour after the D.F.P. medication (average of six experiments: R.E., 34 mm. Hg; L.E., 39 mm.). Four experiments with the intravenous injection of calcium gluconate, followed after 10 minutes by the use of D.F.P., showed rise in tension to an average of 50 mm. Hg (four experiments). In the iontophoretically treated eyes the protein level in the aqueous slightly exceeded (average of 613 mg. percent) that of the control eyes (average of 536.3). The diffusion of the dye T-1824 and the constriction of the pupil caused by the use of D.F.P. were not essentially changed under the treatment with the calcium salt.

B. Adrenal-cortex extract. The study was limited to the use of one preparation

of whole cortical extract (Upjohn), which contained 50 dog units or 2.5-rat units per cc. The intravenous route was selected in two series. After measuring the tension of both eyes, 0.5 cc. per kg. of extract (25 dog units) was injected and the changes in intraocular pressure were followed over a period of 24 hours without any other treatment. In another group of animals the protein concentrations in the aqueous were determined 90 and 120 minutes after the experiment was begun and were compared with those of untreated rabbits which had been subjected to similarly timed tonometry. In a second series three drops of the D.F.P. solution were placed in one or both eyes 15 minutes after injection of the extract. Tonometric readings were obtained 30 minutes to 24 hours after instillation of the D.F.P. solution. T-1824 was used only in a few instances.

A small group of rabbits was treated by injection of 0.05 cc. of extract under the conjunctiva; 30 minutes later the D.F.P. solution was applied and the tension was determined after 30, 90, 150 minutes, and 5 hours.

RESULTS

The intravenous use of adrenal cortex extract in otherwise untreated animals was followed by a gradual lowering of the ocular pressure to a minimum reached six hours after injection. The average difference between the readings taken before the injection and the values six hours later was 7 mm. Hg (nine experiments). Massage effect of the tonometric procedure was improbable since in control experiments such a response was absent when tonometric measurements had been repeated at hourly intervals. The tonometry on untreated rabbits' eyes apparently caused some irritation which led in several instances to an increase of protein content in the aqueous; in one instance

* Neo-calglucon, Sandoz Chemical Works, Inc., was used.

it reached 196 mg. percent. This effect was not evident in eyes of rabbits which had received the injection of adrenal-cortex extract. Here the average of the protein content of 10 eyes was 42.7 mg. percent.

The rise in tension due to the use of D.F.P. was not greatly influenced by treatment with adrenal-cortex extract.

COMMENT

Calcium gluconate introduced by iontophoresis, subconjunctival injection, or by the intravenous route was ineffective in counteracting the increase in capillary permeability and in ocular tension following the local use of D.F.P. in rabbits. The permeation of ionized calcium into the anterior chamber after topical sur-

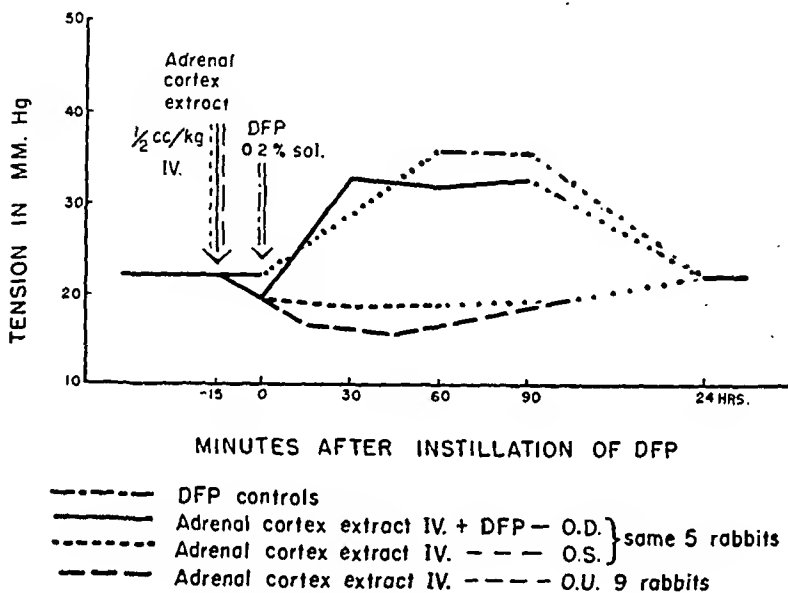


Fig. 6 (von Sallmann and Dillon). Changes in ocular tension after instillation of D.F.P. preceded by intravenous injection of adrenal-cortex extract (Upjohn).

The tension rose from a base value of 23.8 mm. Hg to maximal values around 32.4 mm. Hg in the first 90 minutes and fell to 26.5 mm. Hg after five hours (five rabbits). The control eyes of these rabbits not treated with D.F.P., exhibited a decrease in tension of about 5 mm. Hg. In a simultaneously observed control group of rabbits (four eyes) which were only under the influence of topical D.F.P. applications, the tension increased to an average of 36 mm. Hg. Subconjunctival injection of the hormone preparation in one eye, succeeded by the use of D.F.P. on both eyes 30 minutes later, failed to prevent increase of ocular pressure in two instances and was questionably beneficial in two other instances.

face application so far has not been determined. It will be necessary to augment the number of observations and to modify the experimental procedure before any broader evaluation of the effect of calcium on the ciliary capillaries is permissible.

It is not known how the adrenal cortical extract acts on capillary permeability, and direct observations on the influence of adrenal steroids on capillaries are sparse. Menkin,²⁸ and Freed and Lindner²⁹ noticed reduced filtration of trypan blue from the circulating blood into areas of skin injected with leukotaxin after cortical substances had been added to the toxin. Fine and Fischmann,³⁰ using desoxycorticosterone acetate, confirmed the decrease in the rate at which various dyes

leave the capillaries of the rabbit's ear under the influence of the synthetic product but thought that this effect on the diffusion of the dye was not related to an alteration in capillary permeability. Hyman and Chambers³¹ observed that whole cortical extract added to the perfusion fluid in a dilution of 10^{-8} reduced the rate of edema formation in the frog's hind limbs; the authors were unable to conclude, however, whether this effect was due to a change in capillary permeability. If their results are taken to indi-

4. HISTAMINE ANTAGONISTS

Local mechanical stimulation, lack of oxygen, or any kind of injury may cause considerable transudation of fluid from the blood into the tissue due to increase in capillary permeability. It has been thought that under such conditions the liberation of histamine or a special H substance may give rise to capillary dilation and sometimes to increased permeability. Although the validity of this theory was questioned (Menkin³⁴), the possibility of activating an histamine mecha-

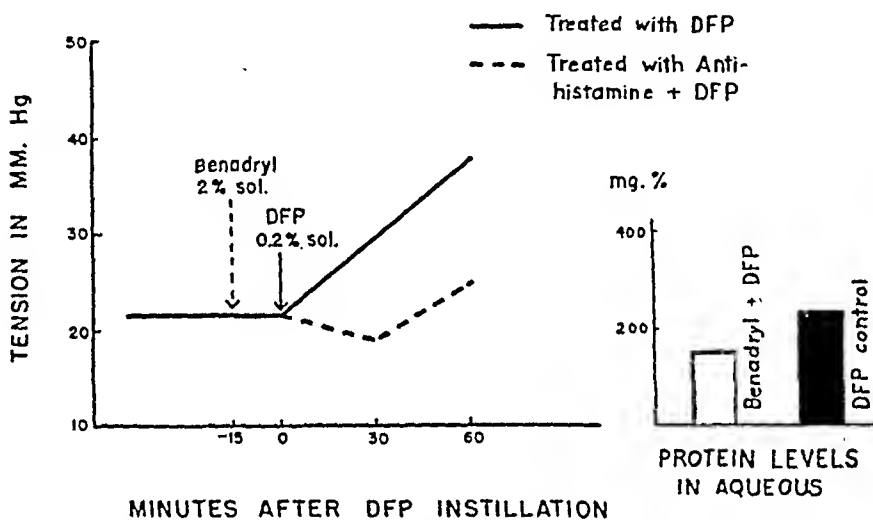


Fig. 7 (von Sallmann and Dillon). Changes in ocular tension after instillation of D.F.P. preceded by instillation of benadryl-hydrochloride solution (2 percent).

cate such a change, an influence of the hormone on the tonus of the capillary endothelium (Chambers³²) or on adsorption of proteins at the intercellular cement (Zweifach³³) could offer an explanation for the phenomenon. At this stage of the investigation no conclusion can be drawn concerning the mechanism by which the cortical extract, injected intravenously, lowered the ocular tension in undisturbed rabbit eyes and prevented the rise of protein content of the aqueous in eyes irritated by repeated tonometry. Further studies are warranted.

nism by stimuli, such as stretching of tissue or rapid increase of the tissue pressure, cannot be excluded. From this viewpoint, the experiments on the effects of drugs on the test lesion under consideration were extended to several histamine antagonists. Three representatives of this group were selected: benadryl (β dimethylaminoethyl benzhydryl ether), hydrochloride, pyribenzamine (N' -benzyl- N' -dimethylaminoethyl aminopyridine) hydrochloride, and antistine (2 [N-phenyl- N' -benzyl-aminomethyl] imidazolin) sulphate.

TECHNIQUE

The compounds were applied topically only by instillation since subconjunctival injections caused considerable irritation. Two drops of a 2-percent solution were deposited in the conjunctival sac, three times, at 3-minute intervals in all experiments. Fifteen minutes later the solution of D.F.P. was used on both eyes. In con-

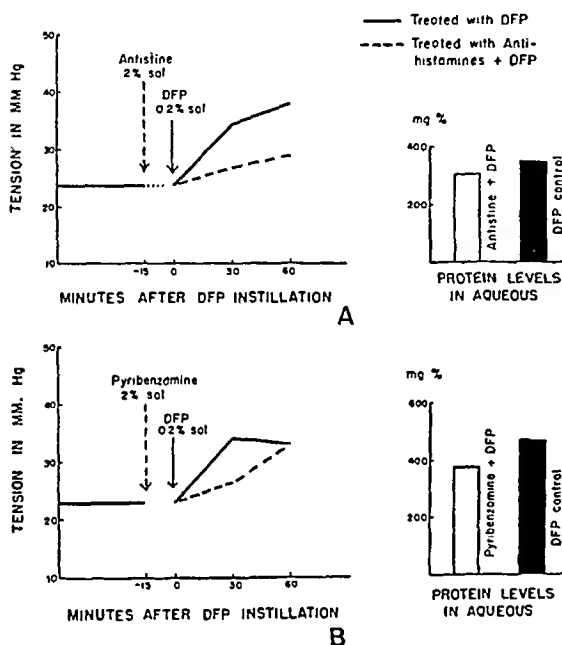


Fig. 8 (von Sallmann and Dillon). Changes in ocular tension and protein levels in the aqueous after instillation of D.F.P. preceded (A) by instillation of antistine-sulphate solution (2 percent); (B) by pyribenzamine-hydrochloride solution (2 percent).

formity with the procedure in the case of other drugs, the tension was taken before treatment was initiated and 15 minutes later; that is, immediately before the employment of the D.F.P. solution. The changes in tension were then followed over a period of 90 minutes and the protein content was determined at the end of this period. In connection with these studies pooled aqueous of eyes pretreated with D.F.P. was tested pharmacologically for histamine activity on the isolated gut of the guinea pig.*

RESULTS

A. Benadryl hydrochloride. One hour after the instillations of the solution of D.F.P., the tension average on the right eyes treated with benadryl and D.F.P. was 24 mm. Hg, on the left eyes treated with D.F.P. alone, 38 mm. Hg (averages of four experiments). The protein concentrations in the aqueous of the right eyes were scattered from 60 to 305 mg. percent and on the left eyes from 60 to 411.4 mg. percent. The difference in the averages (right eye 150, and left eye, 200) cannot be considered significant. The diffusion of T-1824 was delayed in both eyes and moderately more marked in the eyes which had not received benadryl. The pupils of these eyes were relatively dilated when compared with the control eyes (3.4 to 1.2 mm.).

B. Pyribenzamine hydrochloride. The use of this compound did not prevent the tension rise from a base value of 22.8 mm. Hg to 33.7 mm. after one hour (three experiments); the control eyes showed at this time a similar elevation of 36 mm. Hg. The average protein level in the aqueous of the treated eyes was 376 mg. percent when the histamine antagonist was used and 470 mg. percent in the control eyes. Corresponding to these readings, the permeation of the dye was less pronounced in the eyes treated with pyribenzamine. The pupils of these eyes contracted less than in eyes on which D.F.P. had been used alone (3 to 4 mm. right to 1 to 2 mm. left).

C. Antistine sulphate. The tension of eyes treated with antistine and D.F.P. showed an average increase from 23 to 29 mm. Hg one hour after instillation of D.F.P. solution. Control eyes on which D.F.P. alone had been used gave an av-

* These experiments were conducted by Dr. A. Gellhorn of the Department of Pharmacology, College of Physicians and Surgeons, Columbia University.

erage reading of 38 mm. Hg (four experiments). The group of eyes under direct influence of both substances contained 301.8 mg. percent protein, the control eyes 352.5 percent. The intensity of the blue staining also differed from rabbit to rabbit. Usually the diffusion occurred earlier and was greater in the eyes treated with D.F.P. only. In contrast to the two other drugs of this group, antistine did not interfere with the development of the D.F.P. miosis.

When the aqueous of both eyes of five rabbits was withdrawn and pooled 2, 4, and 18 hours following the treatment with D.F.P. (three experiments on 15 rabbits) and amounts of aqueous (up to 1 cc.) were added to a gut preparation in 10 cc. of oxygenated Tyrode solution, no contraction of the gut was observed. A 0.5-cc. solution containing 1.0 γ per cc. of histamine diphosphate and 0.5 cc. of an 0.000005 molar solution of acetylcholine caused intensive contraction of this preparation. It was concluded that these substances, when present in the aqueous, did not reach the effective threshold level.

COMMENT

The new antihistamine drugs possess, besides their main action and anesthetic properties, a parasympatholytic side action and the ability to potentiate adrenergic responses.³⁵⁻³⁹ The quantitative relation between these individual actions varies with the different compounds. Although the ineffectiveness of pooled aqueous of eyes pretreated with D.F.P. on the guinea-pig gut does not exclude the presence of a histamine mechanism, it appears at the present time more plausible to assume that the positive responses observed on tension and in a moderate degree on permeability of ciliary capillaries were brought about by one or another of the side actions of the drugs. The dilation of the pupils of normal rabbits would in-

dicate the action of a sympathomimetic stimulus; however, antistine did not prevent full development of D.F.P. miosis but did influence the tension satisfactorily. The literature on antistine,⁴⁰⁻⁴² a drug which had been used effectively in allergic types of conjunctivitis,⁴³ does not give information on its anticholinergic activity.

The experiments with antihistaminic drugs (like those with calcium and adrenal cortex extract) should be considered preliminary. Benadryl and antistine could have exerted the beneficial influence on the ocular tension of the test lesion by mechanisms other than those operative on capillary permeability. The small difference in the protein level and permeation of the dye T-1824 between eyes treated with histamine antagonists and D.F.P. and eyes on which D.F.P. had been used alone might be explained by absorption of the former compounds from the conjunctiva of the treated eye in amounts sufficient to affect protein permeability of the ciliary capillaries in the other eye. The reduction of the protein level in the aqueous and of the staining intensity in ciliary processes of eyes treated with benadryl and antistine was relatively moderate. This differs greatly from the results of experiments with adrenergic drugs and with pituitrin. Further studies on this new group of drugs on the eye will be necessary for a better understanding of the observed action.

SUMMARY

1. The rise in ocular tension following instillation of a 0.2-percent solution of di-isopropyl fluorophosphate in rabbits is apparently caused by increased permeability of the ciliary capillaries.

2. The outpouring of serum proteins into aqueous roughly paralleled the elevation of tension, but there were great discrepancies in individual experiments be-

tween height of tension and concentration of protein.

3. The blue Azo dye T-1824 was found useful in grading the capillaries of the limbus, iris, and ciliary processes for permeability to the dye and probably to serum albumin. The permeability of the ciliary capillaries greatly exceeded that of the capillaries of the limbus and iris under the influence of the same stimulus.

4. The diffusion of the dye from the circulating blood into the tissue interstices of the ciliary processes and the permeation into the iris and into the chambers of the anterior part of the eye were studied under the corneal microscope and histologically in sections of ciliary body and iris.

5. Biomicroscopical observations on the limbus vessels suggested that the capillaries dilated passively and simultaneously with the distention of the supplying arterioles and metarterioles caused by the cholinergic chemical mediator.

6. Adrenergic drugs and pituitrin effectively counteracted the action of D.F.P. on the ocular tension and capil-

lary permeability in rabbits. The former diminished the miotic effect of D.F.P. far more than did pituitrin.

7. With the technique used, calcium gluconate and adrenal-cortex extract failed to influence the signs of increased permeability of the ciliary capillaries induced by D.F.P.

8. Benadryl, antistine, and to a minor degree pyribenzamine, prevented or reduced the elevation of intraocular pressure caused by D.F.P., but the action on capillary permeability was moderate. Only antistine did not weaken the miotic action of D.F.P.

We are indebted to Dr. M. I. Gregersen for supplying us with the dye T-1824, to Dr. B. W. Zweifach for valuable suggestions, and to Dr. A. Gellhorn for conducting the pharmacological tests with aqueous on the isolated guinea-pig gut.

We want to express our thanks to the the Research Division of Ciba Pharmaceutical Products, Inc., for the donation of the drugs pyribenzamine hydrochloride and antistine sulphate.

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TRANSFER OF ASCORBIC ACID AND RELATED COMPOUNDS ACROSS THE BLOOD-AQUEOUS BARRIER*

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The high concentration of ascorbic acid in the aqueous humor compared with that in the blood has been offered as presumptive evidence that this compound enters the aqueous humor as a result of a secretory process. Previous studies have shown that while this is true for adult animals the concentration of ascorbic acid in the aqueous humor in young animals is essentially the same as in the blood.¹ The difference in young animals has been explained by assuming that the blood-aqueous barrier is sufficiently permeable to permit rapid diffusion from the aqueous back into the blood.²

The implications inherent in the belief that the total transfer of ascorbic acid across the blood-aqueous barrier occurs as a result of a secretory process in adult animals, on the one hand, whereas, a predominant portion of the transfer occurs as a result of diffusion in young animals, on the other hand, have not been con-

sidered previously. Thus, if the transfer took place by secretion, it would be expected that the amount of ascorbic acid which could be transferred across the blood-aqueous barrier would be limited by some factor other than the quantity present in the blood; that is, that the secretory process is capable under ordinary conditions of handling but so much ascorbic acid. If the transfer occurs as a result of diffusion, it would be expected that there would be a direct relationship between the concentration in the aqueous and the blood irrespective of the concentration in the latter fluid. One of the objects of the present paper was to subject these inferences to experimental verification.

A second objective concerns the question of the specificity of the secretory process for compounds structurally like ascorbic acid. It is well known that other carbohydrates having similar size and solubility (namely, glucose) without exception are normally found to be present even in adult animals in the aqueous in lower concentration than in the blood. This is suggestive that any secretory process which can transfer ascorbic acid

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across the blood-aqueous barrier is relatively specific for this compound.

The question of the specificity of the transfer of ascorbic acid across the blood-aqueous barrier is of theoretical importance to a more complete understanding of the secretory process in general. Friedenwald and co-workers³ have shown that ascorbic acid, presumably by reason of its ability to become reversibly oxidized and reduced, acts as a mediator in the oxidation-reduction system associated with the secretory process in general. It is not known, however, whether any portion of the molecule other than that concerned with oxidation reduction, that is, the ene-diol, is necessary either for secretion of other components of the aqueous humor or for the secretion of ascorbic acid itself. It would appear that this question could be resolved by studying the rate of transfer across the blood-aqueous barrier of the enantiomorph of ascorbic acid, d-isoascorbic acid, and d-glucoascorbic acid. D-isoascorbic acid differs structurally only in configuration and d-glucoascorbic acid in the addition of an extra CHOH group between carbon atoms 5 and 6 of ascorbic acid. Both compounds incidentally appear to have oxidation-reduction properties identical with ascorbic acid.

MATERIALS AND METHODS

Albino rabbits were used for all of the experiments. The adult animals were fed a stock diet of Purina rabbit pellets, and the young animals were housed with their mothers.

The test substances were dissolved in glass-distilled water and injected intraperitoneally. Samples were taken from the eye at predetermined times under topical anesthesia (tetracaine HCl) using micropipettes as described previously,¹ and blood was removed by heart puncture. Upon collection, the samples were im-

mediately placed in 4-percent metaphosphoric acid.

All of the analyses were done by means of the dichlorophenol-indophenol titration, and the results of all three compounds tested are reported in terms of ascorbic-acid equivalents. Since the method did not differentiate between the ascorbic acid normally present in the aqueous humor or blood and the compounds injected, the results must be interpreted in terms of change in concentration from the normal level. For the aqueous humor, the normal level is about 20 to 25 mg. percent; and for the blood, about 0.5 to 2.0 mg. percent.

RESULTS

As to the manner in which ascorbic acid is transferred, Figure 1 shows that the

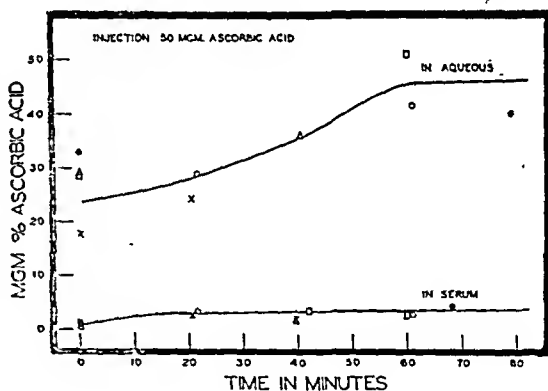


Fig. 1 (Kinsey). Shows the change in concentration of ascorbic acid in the serum and aqueous humor at various intervals following intraperitoneal injection.

concentration of ascorbic acid reaches a maximum in the blood within 20 minutes and that the concentration in the aqueous humor also increases to reach a maximum 60 minutes following intraperitoneal injection. Since the elevated level of ascorbic acid in the aqueous humor is maintained as long as the blood level remains constant, it may be assumed that a steady state is reached at this time.

Figure 2 shows the concentration of ascorbic acid in the aqueous 60 minutes after the injection of various quantities of this compound plotted as a function of the concentration in the blood. It is evident from the graph that the concentration in the aqueous increases rapidly with

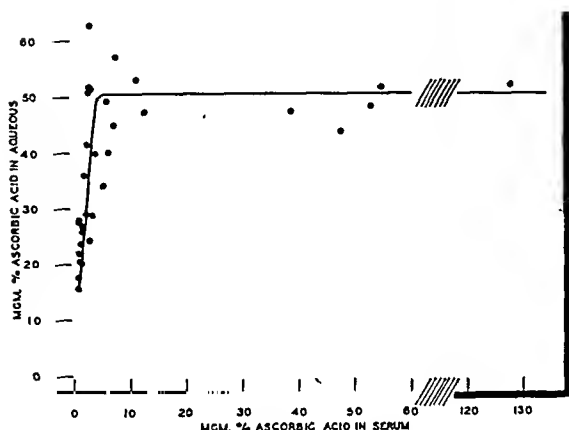


Fig. 2 (Kinsey). Shows the relative concentration of ascorbic acid in the aqueous humor and in the serum of adult rabbits.

increasing concentration in the serum until the level in the aqueous becomes 50 mg. percent. This occurs when the concentration in the serum is 3 mg. percent. With higher blood levels, no further increase in the quantity of ascorbic acid in the aqueous humor was observed, even though the concentration in the serum was elevated to 130 mg. percent.

The same experiments were repeated using young rabbits and the results are represented by the open circles in Figure 3. In this instance it will be seen that the concentration in the aqueous humor rises with increased concentration in the blood throughout the entire range. These results appear to be consistent with the hypothesis previously set forth; namely, that in adult animals ascorbic acid is transferred by secretory process, that some factor other than availability of this compound in the blood limits the amount which can be transferred across the blood-aqueous

barrier, and that in young animals the transfer takes place primarily by the process of diffusion. That the blood-aqueous barrier in adult animals is impermeable to the simple diffusion of ascorbic acid is borne out by the observation that the concentration of ascorbic acid in the aqueous humor does not increase beyond 50 mg. percent, even though the blood level is more than double this concentration. It is interesting to note that molecules considerably larger than ascorbic acid—for example, sucrose—apparently can diffuse through the blood-aqueous barrier. The distinguishing characteristic between ascorbic acid and molecules like glucose and sucrose seems to be that, at the hydrogen-ion concentration found in the aqueous, ascorbic acid is charged; whereas, the sugars are not. This finding offers further support to the theory set forth by the author elsewhere⁴ that electrolytes in general enter the eye by secretion; whereas, nonelectrolytes enter by diffusion.

With regard to the problem of the specificity of the secretory process, Figures 4 and 5 show the results of analyses made on serum and aqueous humor at various times after injecting d-iso ascorbic and

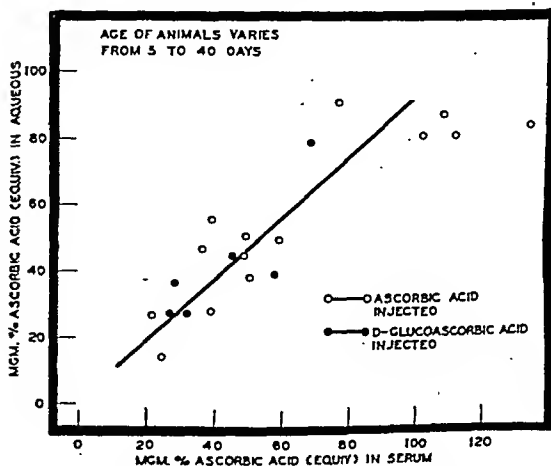


Fig. 3 (Kinsey). Shows the relative concentration of ascorbic acid (open circles) and d-gluco ascorbic acid (filled circles) in the aqueous humor and serum of young rabbits.

d-gluco ascorbic acid into adult rabbits. In both instances the concentration of material titratable with 2:6 dichlorophenol indophenol (expressed as mg. percent ascorbic-acid equivalent) increased in the serum, but only in the case of d-iso ascorbic acid did the concentration of the injected material rise in the aqueous humor.

The filled circles of Figure 3 show the

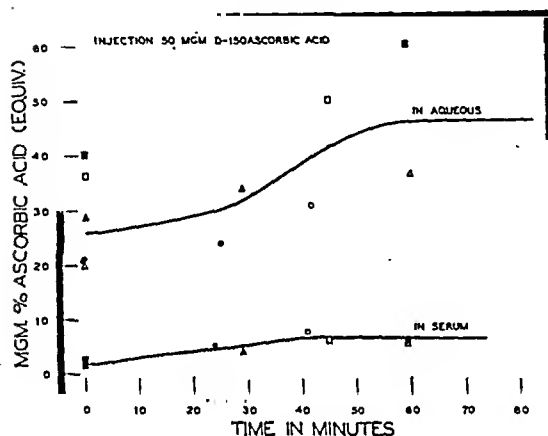


Fig. 4 (Kinsey). Shows the change in concentration of d-iso ascorbic acid in the serum and aqueous humor at various intervals following intraperitoneal injection.

concentration of d-gluco ascorbic acid in the serum and aqueous humor of young rabbits. Unlike the results obtained in the adult animals, it will be seen that d-gluco-ascorbic acid enters the aqueous humor of young animals and does so in proportion to the concentration in the serum.

The results indicate that the secretory process is apparently selective for ascorbic acid or its optical isomere and are suggestive that ascorbic acid forms an integral part of the secretory mechanism as proposed by Friedenwald.³ The secretory process is not as specifically dependent upon a particular structure, however, as are the mechanisms whose malfunction results in scurvy, since d-isoascorbic and d-glucoascorbic have but 1/10 and 1/100 antiscorbutic power of ascorbic acid, respectively.

From the point of view of chemical mechanism, it may be inferred that in addition to the possible participation of that portion of the molecule responsible for the oxidation-reduction property; that is, the enol groups, the part of the molecule around carbon-atoms 5 and 6 are also necessary to the secretory process.

SUMMARY

The distribution of ascorbic acid in the aqueous humor and blood of adult and young rabbits was determined under steady-state conditions. In adult animals the concentration of ascorbic acid in the aqueous was found to increase rapidly with increasing concentration in the blood until the concentration in the aqueous reached 50 mg. percent. This occurred with a serum concentration of approximately 3 mg. percent. With higher blood levels no further increase occurred in the concentration of ascorbic acid in the aqueous even though the concentration in the blood was more than double that in the aqueous humor.

In young animals the concentration of ascorbic acid in the aqueous was found to vary directly with the concentration in the blood. These differences in distribution

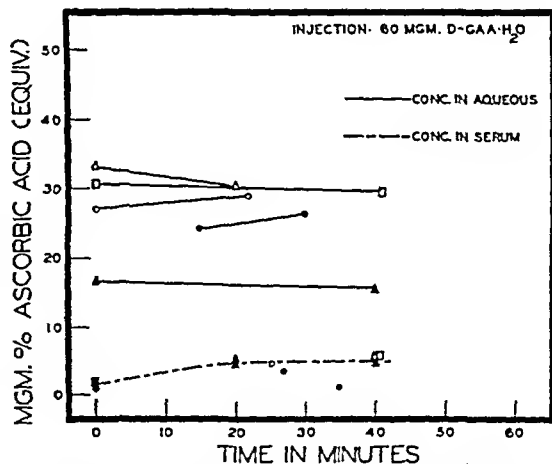


Fig. 5 (Kinsey). Shows the change in concentration of d-gluco ascorbic acid in the serum and aqueous humor at various intervals following intraperitoneal injection.

were thought to indicate that ascorbic acid enters the aqueous humor as a result of a secretory process in adult rabbits; whereas, in young animals the predominating factor in determining the distribution ratio is diffusion. Furthermore, they show that in adult animals some factor, other than availability of this compound in the blood, limits the amount which can be secreted across the blood-aqueous barrier.

The specificity of the secretory process for compounds structurally like ascorbic acid was investigated by injecting d-iso and d-glucoscorbic acid into the per-

itoneal cavity and determining the rate of entrance of these compounds into the aqueous humor in adult and young rabbits. It was found that d-iso ascorbic acid entered the aqueous but no transfer of d-glucoscorbic took place across the blood-aqueous barrier in adult animals. These results indicate that the secretory process is apparently selective for ascorbic acid or its optical isomere (d-isoascorbic acid). The selectivity appears to be unrelated to the antiscorbutic action of these compounds. No selective transfer was observed for these compounds in eyes of young animals.

243 Charles Street (14).

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A STATISTICAL STUDY OF GLAUCOMA*

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In the introductory surveys of glaucoma in monographs and textbooks, there are many statistical data which are, to a certain extent, copied from one work to another. However, it is not always easy to gain a clear impression of the conditions mentioned; such as, the frequency of glaucoma, its distribution according to sex, errors of refraction, and so forth. For many of the conclusions quoted belie each other, often to the confusion of the reader. This may be so not only because the figures are often comparatively small, but also because they hail from material which is so ill-assorted that they are not forthwith comparable.

To a certain extent this fact can be traced to the neglect of some writers to distinguish between the various forms of glaucoma. To be sure, secondary glaucomas are, as a rule, kept by themselves, and this is usually the case also with glaucoma infantum and, perhaps, glaucoma juvenile. Glaucoma simplex and congestive glaucoma are, however, often lumped together. Hence the difficulty in comparing data from different countries. Most statistics show wide fluctuations in the relationship between glaucoma simplex and congestive glaucoma, the one being dominant in certain areas, the other elsewhere. At any rate, it would seem that congestive glaucoma is particularly common in southern countries, certainly more common than in the North where glaucoma simplex is by far the more common form.

My object in presenting certain figures illustrative of conditions in Norway, compared with data I have obtained elsewhere, is not primarily to contribute a

new name or new figures to the long series of earlier statistics. I believe that my Norwegian data may prove deserving of notice and may, perhaps, help to clarify certain problems because they are large in comparison with the figures presented by many other investigators. Besides, my data are so uniform that they should reflect with considerable accuracy the conditions with which we are dealing. As with all statistics, however, the numerical results must be treated critically if we are to avoid drawing false conclusions from them. I would therefore make certain reservations with regard to some of my figures.

SEX INCIDENCE OF GLAUCOMA

My material is derived from the University Eye Clinic in Oslo, and it belongs to the period, 1920 to 1939. During these 20 years, 24,127 patients were admitted to the Eye Department, 13,334 men and 10,793 women. The ratio of men to women was 55.3 to 44.7 percent.

This apparent preponderance of men patients does not make it at once permissible to conclude that eye diseases serious enough to require hospital treatment are more frequent in men than in women in Norway. In the first place, the University Eye Clinic has always had more beds for men than for women. This condition reflects the experience that there really is greater need for beds for men. The capacity of the Eye Department has always, right up to the abnormal conditions during the war, been so great that it has, on the whole, been able to accept all the patients for whom applications for admission have been made. The difference in the numbers of beds available for men and women has, therefore, had scarcely

* From The University Eye Clinic, Prof. Birger Malling, M.D., Chief.

any influence on the relative number of men and women patients admitted.

Another factor to be taken into account concerns the patients whose eye diseases may require hospital treatment, but who remain at home and to some extent at work. For various reasons they do not seek medical advice, or they beg to be excused, or they flatly refuse admission to hospital. It is probable that most such patients are women. For, once a man is so ill that he must remain at home, away from his work, it is seldom difficult to persuade him to go into a hospital. As a rule, a woman must be much embarrassed by eye disease before she completely abandons work at home. Instead of submitting to complete idleness in a hospital, she often remains ailing at home. I consider, therefore, that the figures, 13,334 for men and 10,793 for women, correctly express the relative need of the two sexes for hospital beds for eye disease. However, I doubt if they reflect the true frequency of serious eye disease in the community.

INCIDENCE IN LITERATURE

What of the incidence of glaucoma in the two sexes? The information on this score which I have found in the literature has given me no clear picture.

In *Nordisk Lærebok i Oft.* (1936) we read that: "the predisposition is much the same for both sexes, but it is perhaps somewhat greater for women, particularly in the case of acute glaucoma." *Kurzes Handbuch* (1931) quotes Priestley Smith, according to whom women are in the majority in the ratio of 6 to 5. Schmidt-Rimpler is quoted as putting this ratio at 5 to 4. Luge states that 207 of 300 patients were women. In Beren's *The Eye and Its Diseases* (1936) it is stated that the condition is found somewhat more frequently in women than in men in about the ratio of 6 to 4. In *Traité d'Ophthalmologie* (1938), Morax is

quoted as saying that most authorities believe that chronic glaucoma is about equally common in the two sexes.

In his book on glaucoma (Graefe-Saemisch, 1933), Peters quotes several statistics including those of Schmidt-Rimpler, but he also writes that, according to other authorities, men are more susceptible than women to this disease. He does not, however, give any figures. He goes on to say that Neuffer in Tübingen finds women patients in the majority. He also refers to two writers who have come to conflicting conclusions. Rohner (Basel, 1927) believes that there is no difference between the sexes up to the age of 65 years, after which women are in the majority (396 cases). Luge (1929), on the other hand, found women in the majority, particularly after the menopause. In higher age groups, however, the glaucoma rate was again highest in men!

Elliot (1922) also quotes several of the above-mentioned writers as well as Kogashima, who found glaucoma more frequent in women than in men in the ratio of 62 to 38 percent. Elliot says, however, that in the chronic, noninflammatory forms, the incidence in men may, perhaps, be greater by a small margin.

It will thus be seen that the literature gives us an exceedingly nebulous picture with regard to the sex incidence of glaucoma. This confusion arises from the fact that many writers do not distinguish in their statistics between glaucoma simplex and congestive glaucoma. All who have kept the two conditions separate agree that congestive glaucoma at any rate affects women more often than men.

INCIDENCE IN NORWAY

How do matters stand here in Norway? Taking glaucoma simplex first, I note that it was diagnosed in 2,024 of the 24,127 patients admitted to the eye clinic; that is, in almost 8.4 percent. Of these 2,024 patients, 1,261 (62.3 percent) were

men and 763 (37.7 percent) were women. These figures come from the annual reports of the department. Among them there may be a certain number of patients admitted to the department on several occasions for treatment of the other eye, for reoperation, and the like. On each occasion they received a new case record number and were thus counted as new patients each time. To ascertain if this duplication is of any importance, I have made a direct count of 1,012 patients, and have found 637 of them to be men and 375 women—figures in exact conformity with those of the annual reports. The men were so much in the majority that it cannot simply be due to the greater number of beds for them.

We should also note that glaucoma patients were never refused admission to the department. To be sure, applications on behalf of glaucoma patients for admission are sometimes made under other diagnoses, but this source of error can hardly have played any important part, since we may safely assume that any mistaken diagnoses were equally distributed between the two sexes. It is my conviction, therefore, that the 1,261 cases of glaucoma simplex among men and the 763 cases among women give us an approximately correct impression concerning the distribution of glaucoma simplex between the two sexes in Norway.

The larger number of men becomes further emphasized when we recall that women are in the majority in the age groups in which glaucoma occurs. According to official Norwegian statistics, the census of 1930 showed that, over the age of 50 years, the ratio of men to women was 45.5 to 54.5 percent.

Of 142 patients with bilateral glaucoma, with absolute glaucoma in one eye, there were 96 men and 46 women, and among 118 patients with *nearly* abso-

lute glaucoma of the worse eye, with vision of light perception only or finger counting under 2 meters, there were 82 men and 36 women. Thus, among a total of 260 patients with absolute or nearly absolute glaucoma of the worse eye, there were 178 men (68 percent) and 82 women (32 percent). These figures tally very well with the ratio of men to women in the entire study.

When we consider the cases of congestive glaucoma, we find another state of affairs. Of the total of 143 patients treated for this condition in the Eye Clinic in the period 1920 to 1939, 51 were men and 92 were women, a ratio of 36 percent to 64 percent. In other words, we have here almost the opposite of what we found in glaucoma simplex. However, one of the few points on which all writers agree is that women are more subject to congestive glaucoma than men.

The various statistics show great discrepancies with regard to the relative frequency of glaucoma simplex and congestive glaucoma. This is so to some extent because of an uncertain nomenclature. The usual classification is as follows:

1. Acute congestive glaucoma or merely acute glaucoma.
2. Chronic congestive glaucoma.
3. Chronic glaucoma simplex or merely glaucoma simplex. (Sometimes we find a special group.)
4. Absolute glaucoma.

The term applied to the first group is clear and cannot be misunderstood. As a rule, the diagnosis is not difficult, at any rate not if it is possible to examine the patient and to obtain a case history with its record of typical attacks. The shallow anterior chamber and the lack of exfoliation are also guides to the diagnosis.

Chronic congestive glaucoma, the term applied to the second group, expresses a

vague conception. It may include genuinely acute forms which lack the usual stormy course of an attack. It usually covers those cases of glaucoma simplex which have begun insidiously, which have gradually developed an ever-increasing pressure, and which have finally presented more or less marked manifestations of chronic congestion and inflammatory phenomena. The English term "chronic uncompensated glaucoma" gives a correct picture of this condition without taking the onset of the disease into consideration. Presumably certain cases of secondary glaucoma, notably when they follow thrombosis of the central vein, will also be included in this group.

Group 3 includes those cases we are accustomed to describe merely as glaucoma simplex, and this designation is, as a rule, clear and straightforward.

The term applied to Group 4, absolute glaucoma, is an unfortunate one, for it merely signifies a stage in the development of the disease and does not tell us the form of glaucoma with which we are confronted. I believe that the cases usually included under the diagnosis of absolute glaucoma represent, in most instances, glaucoma simplex in a far advanced stage but without manifestations of irritation. When there are signs of irritation, the diagnosis is often chronic congestive glaucoma. The cases of acute glaucoma leading to blindness are, as a rule, easily recognized and are accordingly given the diagnosis of acute glaucoma.

In his statistical analysis, Ahlström gives the frequency of the various forms of glaucoma as follows:

<i>Classification</i>	<i>Percent</i>
1. Prodromal conditions in	3.6
2. Acute glaucoma	6.5
3. Chronic congestive glaucoma	24.9
4. Glaucoma simplex	41.7
5. Absolute glaucoma	23.3

The terms employed for the first and last groups are primarily indicative of stages of the disease; whereas, the terms in the three other groups refer to the clinical manifestations of the disease. The groups cannot, therefore, be compared with each other without further delineation.

A classification resembling Ahlström's is adopted by v. Grosz of Budapest in his large statistical study, extending over 30 years, of 52,032 patients, 5,958 of whom (11.4 percent) suffered from glaucoma. He presented the following groups:

<i>Classification</i>	<i>Num- ber</i>	<i>Per- cent</i>
1. Glaucoma inflammatorium in a prodromal stage.	453	7.8
2. Glaucoma inflammatorium acutum.	792	13.3
3. Glaucoma inflammatorium chronicum	2,967	49.7
4. Glaucoma absolutum.	1,124	18.8
5. Glaucoma simplex.	622	10.4

In this classification Groups 1 and 2 can be fused together. Group 3 evidently belongs, in the main, to Group 5, as does Group 4. By limiting ourselves to two groups we shall, at any rate, not include too many cases in the glaucoma inflammatorium acutum group.

These statistics show that the relationship of glaucoma inflammatorium to glaucoma simplex varies greatly. While, according to Ahlström, glaucoma acutum is responsible for 6.5 percent (at most 10.1 percent) of all the cases of glaucoma, the corresponding figures, according to v. Grosz, are 13.3 percent (or at the most 21.1 percent).

In his *The Eye and Its Diseases*, Berens says that glaucoma simplex is about 10 times as common as the uncompensated forms of glaucoma, but in a later table he quotes figures from his own practice showing 77 cases of compensated, 33 acute uncompensated, and 44 chronic uncompensated.

My own statistics show: Glaucoma inflammatorium, 143 cases of 6.6 percent; glaucoma simplex, 2,024 cases or 93.4 percent. These figures tally quite well with Ahlström's, and this would be expected since the ethnical background of Ahlström's patients and mine is similar; whereas, v. Grosz's patients come from southern and eastern countries and belong to other ethnical groups.

REFRACTIVE ERRORS IN GLAUCOMA

What are the most common refraction findings in patients who develop glaucoma? Much information is available on this, but the various textbooks deal, to a large extent, with statistics from the same authors, and figures are either not mentioned or are comparatively small.

A statement in *Nordisk Lärebok* says: "... among refraction findings hyperopia seems to predispose to stasis glaucoma. Simple glaucoma appears to occur independently of the state of refraction of the eye."

According to a statement in *Traité d'Ophthalmologie*, Gilbert in Munich found hypermetropia in 38 percent of his cases and emmetropia or myopia in 62 percent (71 cases), but hypermetropia was found in 77 percent of the cases of glaucoma acutum. Morax insists that inverse astigmatism is of some importance, and he recommends pressure control when this error of refraction is found.

Elliot says: "Hyperopia is the commonest refraction error met with in eyes affected with primary glaucoma." He quotes Gilbert and also Lange, who found myopia in 43 percent of his cases. According to *Kurzes Handbuch*, hypermetropic eyes are quite definitely more often attacked by glaucoma than myopic eyes. Peters remarks that hypermetropia is said to have a causal relationship to glaucoma because of the smallness of the

cornea, the narrower filtration angle, and the greater rigidity of the sclera. But myopia also occurs frequently (cit. Lange and Gilbert).

In his textbook, Berens says: "The refractive error of the eye is of interest, as it was formerly believed that only hyperopic eyes were subject to compensated glaucoma. We now know that this view is erroneous and that, although the anatomic build of the hyperopic eye renders it more susceptible to glaucoma than that of the myopic eye, other factors are of greater importance."

He then proceeds to relate his own experience with his last 188 cases of glaucoma, only 77 of which were "compensated." Among these 77 cases were 50 of hyperopia (65 percent), 19 were cases of myopia (25 percent), and 8 showed mixed astigmatism (10 percent). Thus, strangely enough, he had no case of emmetropia. Among his cases of hyperopia there were 24 with less than +1.50D. of hyperopia, and among his cases of myopia there were 15 with less than 6.00D. of myopia.

In the opinion of certain writers, however, the development of glaucoma in persons with myopia is so rare as to inspire the publishing of several cases in which special reference is made to the combination of the two conditions. In 1929, Schenk stated that glaucoma seldom occurs in myopics; whereas, in the same year Meyerhofer stated that glaucoma and myopia often occur together in Egypt (in 12 out of 183 cases).

For my own part, I have kept a record of the refractive errors in glaucoma only during the 11 years, 1928 to 1939. The refraction was in every case measured before operation by Donders' subjective method. During this period, refraction conditions of 1,417 eyes suffering from glaucoma simplex were recorded. The refraction conditions were as follows:

Type	Percent
Hyperopia	25.6
Emmetropia	50.7
Myopia	19.1
Astigmatism	4.6

I have also divided up these cases into smaller groups so as to show the occurrence of the more marked errors of refraction (table 1).

Table 1 shows that most of the cases group themselves about emmetropia

in about 30 percent of these cases; hypermetropia in about 55 percent; and myopia in about 15 percent. A refraction of +1.00D. is counted as hypermetropia. If his curve is correct, my figures do not show that persons with hypermetropia are particularly subject to glaucoma simplex, but rather the reverse; that is, that they are less likely to contract glaucoma than persons with other refractive errors. To facilitate a comparison, I have placed Herrnhaiser's figures for refraction con-

TABLE 1
REFRACTIVE CONDITIONS IN GLAUCOMA SIMPLEX

Refractive Error	More Than +2. D.	Less Than +2. D.	Between +.5 D. - .5 D.	Less Than -2. D.	Less Than -6. D.	More Than -6. D.	Astigmatism		
							+	-	Inverse
Number of Patients	79	288	719	178	78	23	23	18	29
Percent	5.5	20.1	50.7	12	5.4	1.6	1.6	1.2	2.0

which is the dominant refraction condition in glaucomatous eyes. The exaggerated errors of refraction are represented by small groups. It is particularly striking that the hypermetropic group is so small.

What is the frequency of the various errors of refraction in a normal group? Many investigations have been undertaken of refraction conditions in different groups of the community and also in certain age groups, but I have not found any investigation giving a straightforward account of the various refraction conditions in the higher age groups. However, Herrnhaiser (*Kurzes Handbuch*) has presented a curve showing the distribution of refraction conditions in various age groups. After the age of 30 years, conditions are more or less constant, but with a tendency to an approach to emmetropia after the age of 70 years in the subjects of both myopia and emmetropia. He says that emmetropia occurs

conditions in normal groups beside my figures for these conditions in glaucoma groups.

Normal	Glaucoma
(Herrnhaiser)	(Holst)
Hypermetropia, 55.0%	Hypermetropia, 25.6%
Emmetropia, 30.0%	Emmetropia, 50.7%
Myopia, 15.0%	Myopia, 19.0%

Here it is remarkable that the incidence of myopia is higher among glaucoma patients than in a normal group; whereas, hypermetropia is only half as frequent among glaucoma patients as in a normal community.

It is conceivable that my figures are vitiated by several sources of error. As already pointed out, the refraction was measured before operation, but patients in several cases had suffered from glaucoma for some time and had, as a rule, been treated with pilocarpine. Although we were dealing with elderly patients, some of them could have retained a little

accommodation. In such cases, pilocarpine may have induced an "accommodation cramp" which can simulate myopia. Further, it is possible that, in some cases, the glaucoma may have led to degenerative changes in the eye, such as early cataract, which betrayed themselves as a lenticular myopia. My material does not provide sufficient information to determine whether many of my patients have become myopic as the result of pilocarpine medication or through the progression of

showed inverse astigmatism seems to support Morax's assumption that this condition predisposes to glaucoma. We should, therefore, do well to follow his advice and carefully supervise the ocular pressure of patients suffering from inverse astigmatism.

Unfortunately, with regard to congestive glaucoma, I have information concerning the refractions of only 59 patients with a total of 75 eyes presenting this condition. Their refractions are

TABLE 2
REFRACTIVE CONDITIONS IN CONGESTIVE GLAUCOMA

Refractive Error	Hypermetropia			Emmetropia	Myopia		Unknown
	More Than +6.00 D.	More Than +2.00 D.	Less Than +2.00 D.		Less Than -6.00 D.	More Than -6.00 D.	
Number of Eyes	3	11	19	25	6	2	9
Total (75 Eyes)	33			25	8		9

the glaucoma, but the shifting of the refractive conditions from hypermetropia to emmetropia and myopia could have glaucoma as a causal or predisposing factor. Nor can any definite answer to this question be obtained by investigating the refractions of patients with unilateral glaucoma and anisometropia.

In 80 of 97 cases of unilateral glaucoma and anisometropia, the refraction showed the glaucomatous eye to be more myopic than that of the healthy eye, but, as already pointed out, we do not know what the refraction of the glaucomatous eye was *before* the manifestation of signs of glaucoma.

It will be noted (table 1) that I found astigmatism in 4.8 percent of the cases studied (myopic, regular astigmatism a little more frequently than hypermetropic, regular astigmatism). The fact that as great a proportion as 2 percent of my cases

shown in Table 2. The figures in Table 2 do not differ greatly from Herrnheiser's normal figures. If we are to draw any conclusion whatever from this small number of cases, it would seem that hypermetropia plays a considerably more important part in congestive glaucoma than in glaucoma simplex, while the combination of myopia and congestive glaucoma is more rare than that of myopia and glaucoma simplex.

FIRST EYE TO BE ATTACKED

Which eye is most frequently the first to be attacked by glaucoma? According to Schmidt-Rimpler, the right eye is not only more often the first to be involved but also, when the disease is confined to one eye, the right is most often that one eye.

When the patient presents himself with advanced bilateral glaucoma, it is not

always easy, however, to say which was the first eye to be attacked. Frequently, he notices definite signs of the disease in one eye before the other, and the development of glaucoma is often marked by such different stages in the two eyes that we are justified in concluding that it began in the eye in which the disease is most advanced. A record of 1,040 patients kept by me during the last 11 years shows that glaucoma began in the right eye in 390 cases, and in the left eye in 486 cases; whereas, in 164 cases information on this point was lacking for various reasons. These figures do not tally with those given by Schmidt-Rimpler, but they do agree with the records of the University Eye Clinic in Oslo for the period 1928 to 1939 when a greater number of left eyes (375) than right eyes (345) were operated for glaucoma simplex. The small difference between these two figures *may*, to a certain extent, be explained by this hypothesis:

If it is true that glaucoma more frequently attacks the left eye before it does the right eye, *then* more left than right eyes are the seat of absolute glaucoma and are *not* operated because the condition in the left eye is hopeless; whereas, the right eye, still possessing useful vision, is operated on.

This hypothesis can, moreover, be substantiated by facts. Of 189 eyes presenting absolute glaucoma, or nearly absolute, and not subjected to any glaucoma operation, 102 were left eyes and 87 were right eyes. Further, among 196 patients with unilateral glaucoma, the left eye was involved in 119 cases, the right eye in 77. These figures would seem to indicate that the left eye is more prone to glaucoma than the right, but why this is so I cannot say.

EXFOLIATION OF LENS CAPSULE

The presence or absence of exfoliation

of the lens capsule is of great interest in cases of glaucoma. Here in Norway, Hörven's researches in this field have attracted special attention. He says that "we can take it as proved that between 60 and 70 percent of the patients presenting exfoliation suffer at the same time from glaucoma." Indeed, Vogt has found glaucoma in as great a proportion as 75 percent of his cases of exfoliation. Several other writers mention similar figures.

How many glaucoma patients suffer from exfoliation? Data concerning this point are most varied. According to Hörven, various writers put this rate at 8 to 9 percent (Vogt, Blaickner) while others put it at 40 to 50 percent (Malling, Baumgart, Lindberg). Hörven, himself, found that 85 percent of his 150 glaucoma patients suffered from exfoliation. However, it is surprising how little interest has been taken in this matter and how seldom exfoliation is demonstrated. In certain hospitals the lists of diagnoses include a special heading, "glaucoma capsulare," under which very modest figures are to be found.

In my study, examinations for exfoliation have been carried out only since 1936 (after the appearance of Hörven's thesis for the degree of Doctor of Medicine). During this period information about exfoliation has been obtained in the study of 459 cases of glaucoma. It was found in 375 cases (82 percent). This observation falls well in line with Hörven's. All the patients were examined in focal illumination with Hartnack's loupe. Most of the patients, who yielded negative findings on this examination, were also examined more closely with a slit-lamp; some, but not all, under glaucosan mydriasis. It is conceivable that a more consistent and detailed examination would have shown still more cases of exfoliation.

It is noteworthy that among these 459

patients, there were 53 with unilateral glaucoma in whom exfoliation was found in one eye only, and that one eye was invariably the glaucomatous eye. We are, therefore, fully justified in assuming a close association between exfoliation of the lens capsule and the condition we call glaucoma simplex.

Unfortunately, my statistics regarding any association existing between congestive glaucoma and exfoliation are most incomplete. In only 10 cases was an examination for exfoliation recorded. In none of these 10 cases was exfoliation demonstrated.

SUMMARY

At the University Eye Clinic in Oslo, in the period 1920 to 1939, there were 24,127 admissions, 13,334 patients (55.3 percent) were men, and 10,793 (44.7 percent) were women. Among these 24,127 admissions were 2,024 cases (8.4 percent), of glaucoma simplex; 1,261 were men (62.3 percent), and 763 women (37.7 percent). The fact that men greatly outnumbered women is more surprising when it is remembered that in the age group (over 50 years) in which the incidence of glaucoma is most high, the percentage of men to women is 45.5 to 54.5.

Of the 143 patients suffering from congestive glaucoma, 36 percent were men, 64 percent, women; that is, a ratio almost the reverse of that for glaucoma simplex.

A comparison of the frequency of the two forms of glaucoma shows that glaucoma simplex constituted 93.4 percent of all the cases; whereas congestive glaucoma constituted only 6.6 percent.

With regard to the refractions of pa-

tients with glaucoma simplex, hypermetropia was found in fully 25 percent; emmetropia in fully 50 percent; and myopia in 19 percent; and almost 5 percent were astigmatic. These figures, when compared with Herrnheiser's "normal curve" show that, in the present material, there were only half as many subjects of hypermetropia as one can expect to find in a normal population; that there were more cases of myopia; and that the preponderance of emmetropia was very marked.

The information provided by the present study fails to show whether the shifting of refraction in the direction of myopia is a predisposing cause of glaucoma, or a consequence of it, or the result of treatment given for it (changes in the lens, pilocarpine).

Inverse astigmatism was found in as great a proportion as 2 percent.

Among 1,040 glaucoma patients, there were 390 whose disease began first in the right eye, and 486 whose disease began first in the left eye; whereas, in the remaining 164 cases information was not forthcoming as to which eye was first attacked.

In 459 cases an examination was undertaken for exfoliation of the lens capsule which was found in 375 cases (82 percent).

In the 53 cases of unilateral glaucoma in which exfoliation was found on only one side, it was always found in the glaucomatous eye only. The reverse condition, with exfoliation in the healthy eye, but not in the glaucomatous eye, was never observed.

Pilestredet 28.

THE DIAGNOSIS OF EARLY GLAUCOMA*

HENDRIE W. GRANT
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In the presence of symptoms of unrelieved asthenopia, subnormal or unequal accommodation, a variation of more than a few mm. in the tension of the two eyes, sclerosis of the lens nucleus, or the history of glaucoma in the family, one should institute a searching examination for evidence of early glaucoma. Contraction of the peripheral fields and cupping of the optic nerve are late symptoms. Although routine determination of the ocular tension may be found to be normal, enlargement of the blindspot is present if the tension has been recently elevated. At this early stage, when paracentral field changes are present, the process may still be a reversible one, but normally does not occur until the tension has been normal for a considerable period of time. Since in early glaucoma the tension may be elevated for only a few hours each day, enlargement of the blindspot is found in the presence of normal daytime tension. The evaluation of the changes from the normal to the enlarged blindspot, the reversibility of the enlargement, along with the details of the study are here described.

METHODS FOR DIAGNOSIS

Many methods for the diagnosis of early glaucoma have been described, especially methods of increasing the intraocular pressure. In such instances the diagnosis is made upon the increased pressure alone. These methods are: massage test, Knapp, 1912; dark-room test, Seidel, 1914; decubitus test, Köllner, 1916; adrenalin test, Knapp, 1921; fluorescein,

Thiel, 1922; caffeine test, Wegner, 1925; drinking test, Schmidt, 1928; venous-congestion test, Wegner, 1930; paracentesis test, Kronfeld, 1930; reading test, Gradle, 1931; mydriasis test.

Ferree, Rand, and Sloan have shown the sensitivity of the paracentral area to scotomas and the value of red and green test objects in individuals suffering from frank glaucoma with constantly elevated tension (sometimes controlled with miotics).

Sloan described the early paracentral field changes in early glaucoma, principally arcuate or sickle type of scotomas. These were divided into (1) scotomas which encircled the fixation point, (2) relative scotomas present without absolute scotomas, (3) scotomas which decreased or disappeared with the use of pilocarpine. Sloan further confirmed the opinion of Samojloff that the sickle type of scotoma disappears quickly after the use of pilocarpine but only after prolonged use in more advanced cases.

Sloan, Peter, and Traquair have discussed the association of the arcuate scotoma with the blindspot, and its isolation from the blindspot. On the other hand, Thomasson found that an isolated scotoma is never an early manifestation of glaucoma, all early scotoma being attached to the blindspot itself.

This paper presents data on 27 cases of increased intraocular pressure without evidence of cupping of the optic nerve or changes in the peripheral field, one case of slight cupping, two cases of shallow anterior chambers, and three cases without increased tension. These patients, observed over a period of 6 months to 7½ years, have had frequent

*Read at the 82nd annual meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.

determinations of the ocular tension plus detailed study of the blindspots. Every case of glaucoma with cupping has been eliminated except the one case previously mentioned.

TONOMETRIC READINGS

In the diagnosis of early glaucoma there seem to be several difficulties in taking tonometric readings. It is not easy to teach residents and ophthalmic assist-

progressive presbyopia, unequal accommodation, asthenopia not relieved by adequate correction, difficulty in reading in the early morning, the presence of nuclear sclerosis, and blindness in the mothers of three of the patients were some of the reasons for study.

The tonometer used was of the Gradle-Schiotz type. It was sent to a standardizing station and found to be in good mechanical order. Reconversion tables were

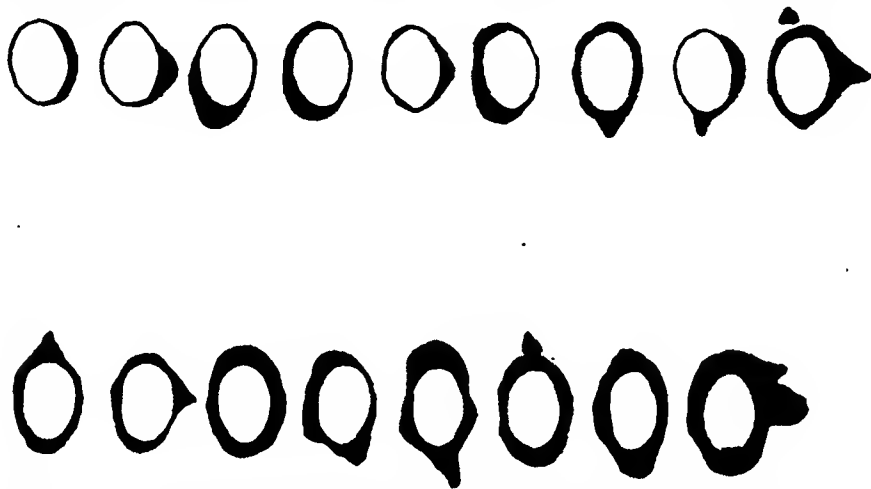


Fig. 1 (Grant). Changes in blindspot in early glaucoma as shown in several cases without cupping of the optic nerve but having increased tension.

ants the art of taking tonometric readings, so wide variations occur. Slight variations of 3 to 5 mm. cause marked changes in the paracentral field; whereas, it may be difficult to make a diagnosis of glaucoma on a rise of from 3 to 5 mm. of intraocular pressure. Evans has stated that careful mapping of scotomas is a much more sensitive indication of increased intraocular pressure than any tonometric measurement. It is believed also that residents and assistants obtain more uniform field studies than tonometric readings, and that both are essential in establishing a diagnosis of glaucoma.

Many reasons besides routine tonometric readings were present in this group for detailed field studies. Rapidly

never received and the tonometer was standardized as follows: Many routine tests were performed on the blindspot with tensions varying from 20 mm. upward. It was found that no change occurred in the blindspot with a 1-mm. test object on the tangent screen at one meter with tensions up to and including 28 mm., with three exceptions noted. Similar normals were present for 4-, 8-, and 12-mm. red test objects at one meter. When, however, the tension was above 28 mm., demonstrable changes were present in the paracentral field. I have observed also that all individuals seemed to have the same limit of normal tension.

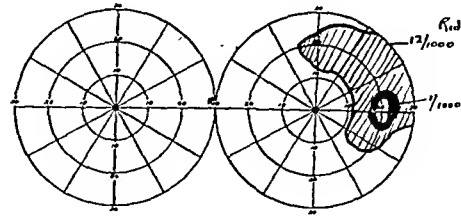
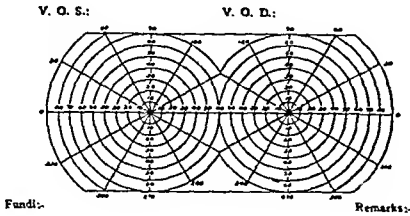
ENLARGEMENT OF BLINDSPOT

The earliest change noted is a relative

enlargement of the blindspot which may be observed for red test objects of 4, 8, and 12 mm. The earliest absolute changes are winglike scotomas which appear on the temporal sides of the blindspot either

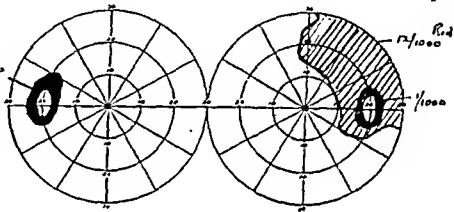
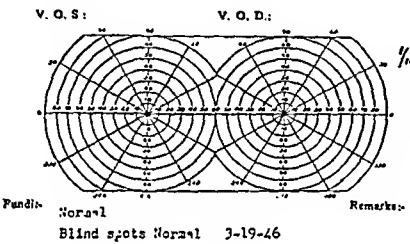
the blindspot may be almost round. At the onset these scotomas appear and disappear with the rise and fall of tension, in some cases disappearing completely if the tension falls to normal and remains so. Im-

Date: 10-16-45 Examiner: 13,971 H.S.



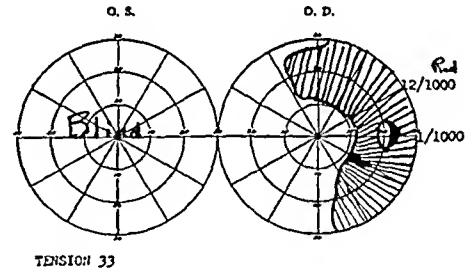
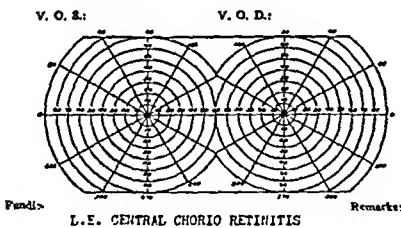
Date: 11-25-45

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Examiner:



Date: 12-4-45

Examiner: 14,385 - F.J.S.

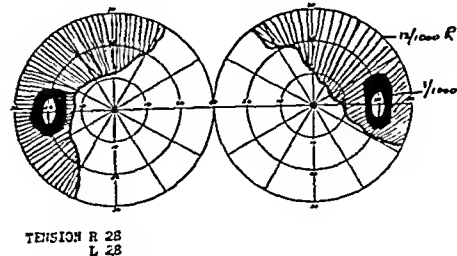
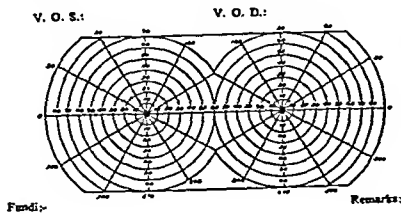


Fig. 2, Part 1 (Grant). Changes in blindspot for $1\frac{1}{2}$ mm. white and 12 mm. red on a standard 1-mm. screen.

as tonguelike protuberances or as a gentle elongated enlargement along the whole side. The upper and lower poles remain normal and may have a very pointed appearance if there is marked widening, or

provement, however, occurs very slowly, and several weeks or months may elapse before normalcy is reached. Small tongue-like elongations appear at the upper and lower poles only after lateral enlargement

has occurred. It would appear that the coalescence of these small winglike and tongue-like scotomas ultimately causes the permanent irregular enlargement of the blindspot. No sickle or arcuate type of scotomas appears attached to or free from the normal blindspot, only on the enlarged blindspot. In the early or late stages, the sickle type is separated from the blind-

strated in individuals who have normal tension for most of the day with elevation for only a few hours in the early morning, or elevated artificially by one of the previously suggested methods. I have found, however, that checking of the tension and blindspots very early in the morning as soon as the patient is out of bed will, in most instances, eliminate the

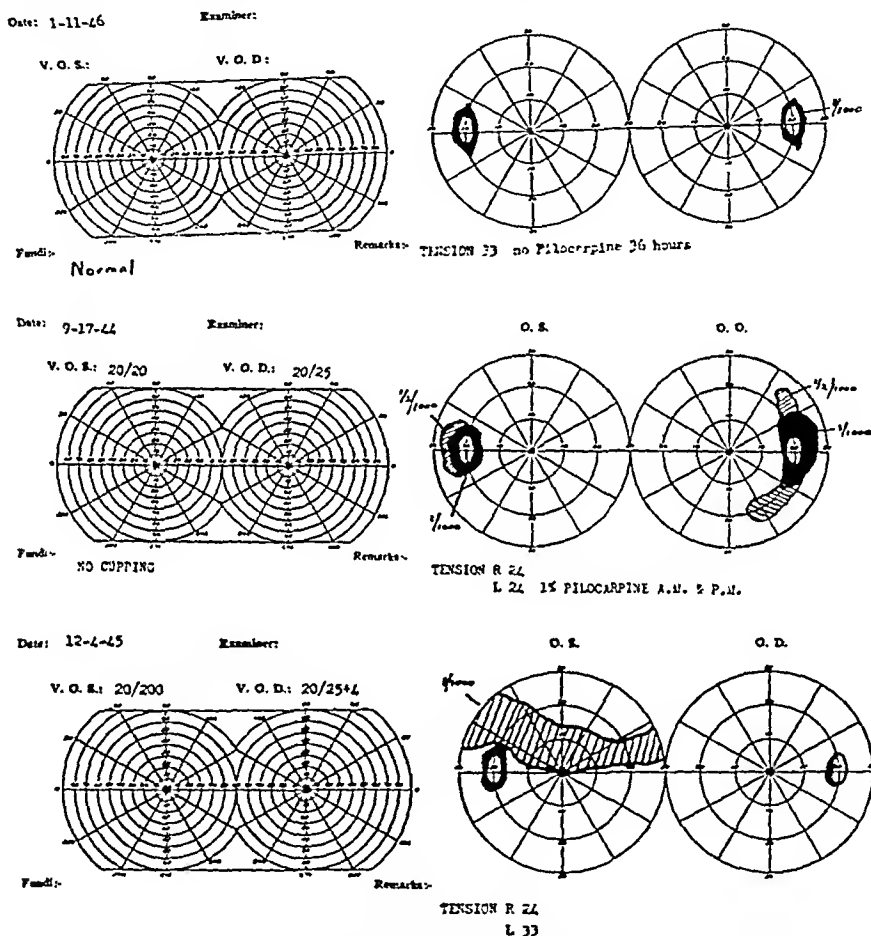


Fig. 2, Part 2 (Grant). Changes in blindspot for $1\frac{1}{2}$ mm. white and 12 mm. red on standard 1-mm. screen.

spot by a small area of vision, especially so if these appear for an hour or so when the tension is elevated, and disappear with the reduction of tension. Only when the condition is more advanced is the arcuate scotoma attached to the blindspot itself. These observations concur with those of Thomasson.

These early changes are easily demon-

nstrated in individuals who have normal tension for most of the day with elevation for only a few hours in the early morning, or elevated artificially by one of the previously suggested methods.

CASE REPORTS

MYDRIASIS TEST

The mydriasis test produces alarming changes in the blindspot in one hour, when positive, as is illustrated by the following cases:

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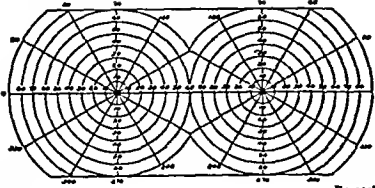
Examiner:

O. S.

O. D.

V. O. S.:

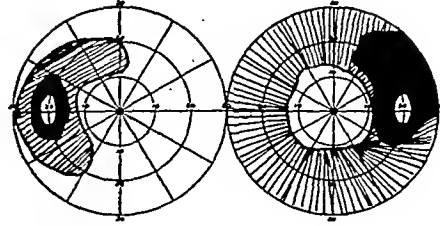
V. O. D.:



Fundi:-

Remarks:-

TENSION R 33
L 43 AFTER PARADRINE
TENSION R 24
L 24 ONE HOUR LATER



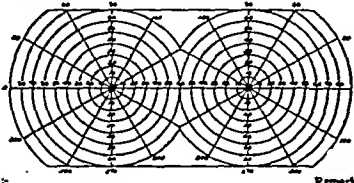
Date: 11-20-45

Examiner:

1291 M.T.

V. O. S.:

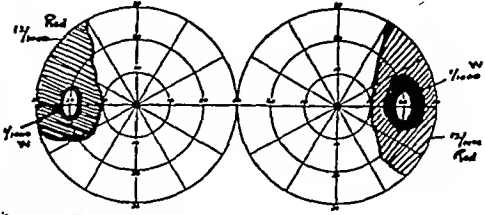
V. O. D.:



Fundi:-

Remarks:-

TENSION R 33
L 28 No Pilocarpine

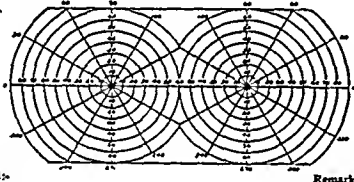


Date: 3-11-46

Examiner:

V. O. S.:

V. O. D.:



Fundi:-

Remarks:-

TENSION R 28
L 28 Blind Spots Normal

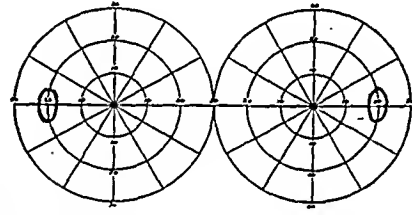
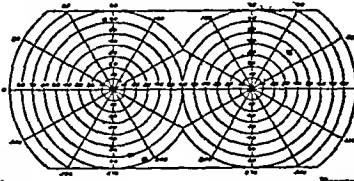


Fig. 3 (Grant). Marked increase in scotoma after use of paradrine, showing very slow return to normal.

Examiner: L. 176 - G.B.

V. O. S.:

V. O. D.:



Fundi:-

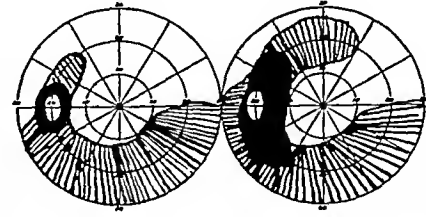
Remarks:-

10-16-45

Left eye
TENSION 28

10-16-45

Left eye - after Paradrine
TENSION 38

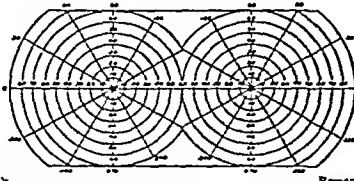


Date:

Examiner:

V. O. S.:

V. O. D.:



Fundi:-

Remarks:-

BLIND SPOT ABOUT NORMAL 5-26-46

10-16-45

Left eye
TENSION 24 after Pilocarpine

Left eye
TENSION 26

1-9-46

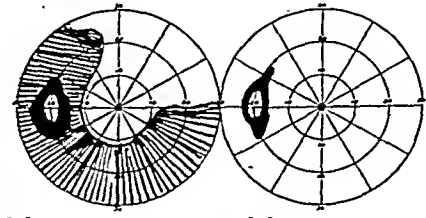


Fig. 4 (Grant). Marked increase in scotoma after use of paradrine showing very slow return to normal.

Case 1. M.-T., (1,291), a woman, aged 70 years, has been under observation since 1934. In 1937 considerable sclerosis of the lens nucleus with many streaks in the periphery of the lens was noted. In October, 1945, the vision was reduced to 20/30 in each eye and the tension was normal at noon. One-percent paredrine was instilled in each eye, causing a rise of pressure to: R.E. 43 mm. Hg; L.E., 33 mm. The paracentral field changes at

ELEVATION OF TENSION FOR A FEW HOURS

That a slight increase in intraocular pressure for a few hours each day may occur over a period of years and produce marked changes is borne out by the following case:

Case 3. C. B. R., a physician, aged 65 years, was first seen in 1933. He had been struck in the left eye six years previously by a piece of copper from an exploding rifle shell, which produced an

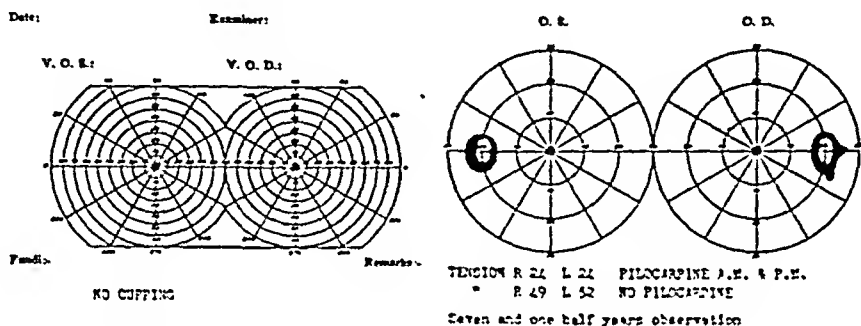


Fig. 5 (Grant). Blindspots of patient 7½ years after observation without cupping of the optic nerve but with marked increase of tension.

that time showed a very marked enlargement and remained so in spite of reducing the tension to 24 mm. in each eye after the lapse of one hour. The blindspots remained enlarged considerably above normal until January 23, 1946, approximately a lapse of three months before they could be considered normal. No cupping of the optic nerve has been present at any time.

Case 2. G. B., (14,167), a woman, aged 67 years, examined in October, 1945, showed a vision of: R.E., 8/200; L.E., 20/25, corrected. The fundus of the right eye showed a retinitis of hypertension, Grade 2, with newly formed vessels on the optic nerve due to a previous vascular accident. There was a slight enlargement of the left blindspot. Paredrine instilled for fundus examination increased the tension to 38 mm. with a marked increase in the size of the scotoma which gradually became normal in May, 1946.

open wound of the conjunctiva but no foreign body was ever found. His vision was 20/20 in each eye and no note was made except a possible slight cupping of the left optic nerve. The tension was: R.E., 20 mm. Hg; L.E., 24 mm. Next observation was in June, 1945, when the vision was: R.E., 20/20; L.E., 20/25. Tension was: R.E. 26 mm. Hg; L.E. 26 mm. Fundi showed slight cupping of both optic nerves. The fields showed slight peripheral contraction, enlargement of both blindspots.

On December 3, 1945, tension was: R.E., 28 mm. Hg; L.E., 28 mm. One hour after the instillation of paredrine, the readings were: R.E., 20 mm. Hg; L.E., 28 mm. On December 5, 1945, on arising, tension was: R.E., 30 mm. Hg; L.E., 33 mm. Fields showed a sickle-type scotoma, detached from the blindspot. This blindspot disappeared in one hour.

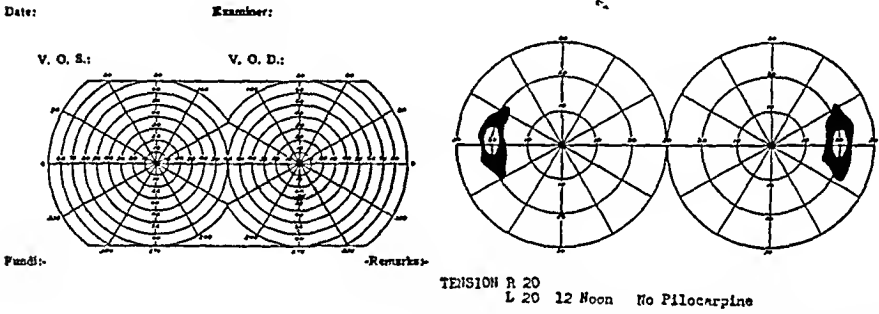
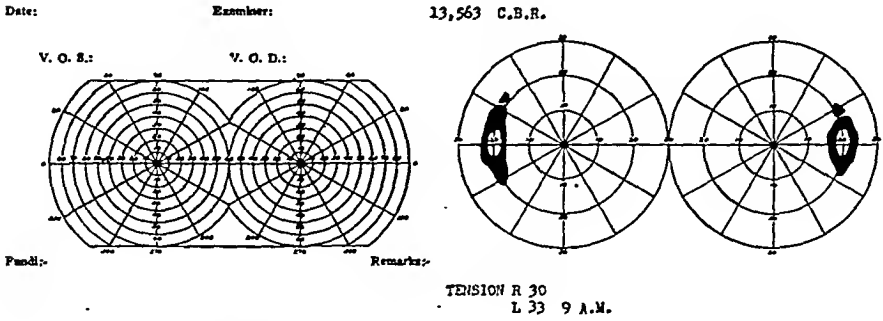
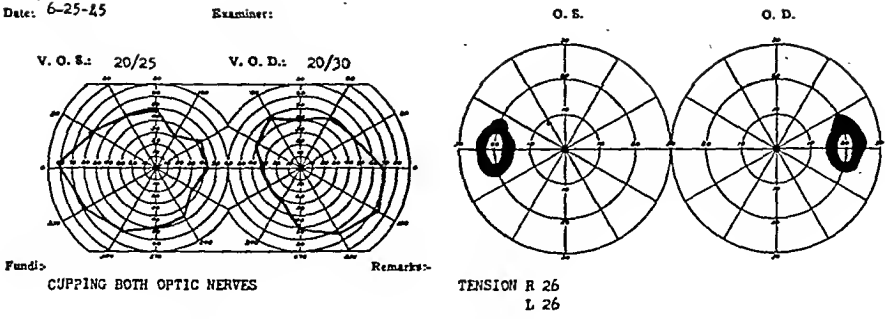


Fig. 6 (Grant). Sickie type of scotoma appearing in early morning, detached from blindspot and disappearing in a few hours when tension became normal spontaneously.

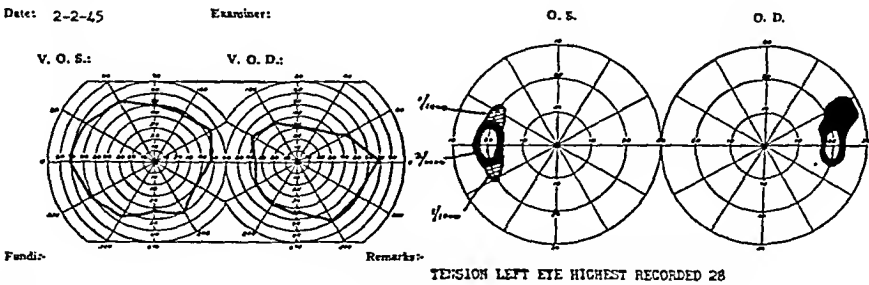


Fig. 7 (Grant). Enlargement of blind spot in shallow chamber with normal tension.

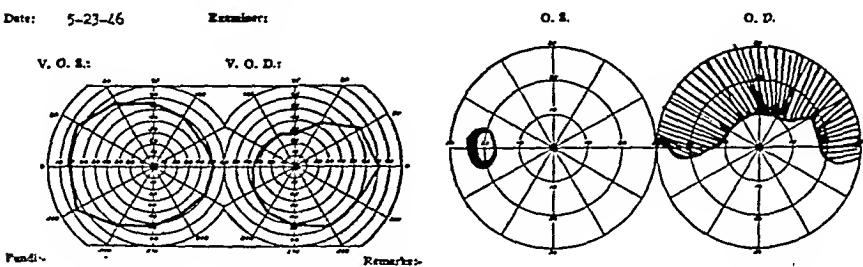


Fig. 8 (Grant). Enlargement of blindspot in shallow anterior chamber without increase in tension.

ENLARGEMENT OF BLINDSPOT WITH NORMAL TENSION

Interest centers chiefly on those cases which Gradle calls the preglaucomatous. In the first instance of the acute congestive type, without increase in intraocular pressure, he states that paracentral field changes are absent. The following

20/20. Tension was: R.E., 55 mm. Hg; L.E., 20 mm. The tension of the right eye was reduced to 20 mm. with 2-per cent pilocarpine every half hour and an iridectomy performed on January 23rd permanently reduced the increased pressure. Records of the 24-hour tension studies of the left eye during her hospital stay

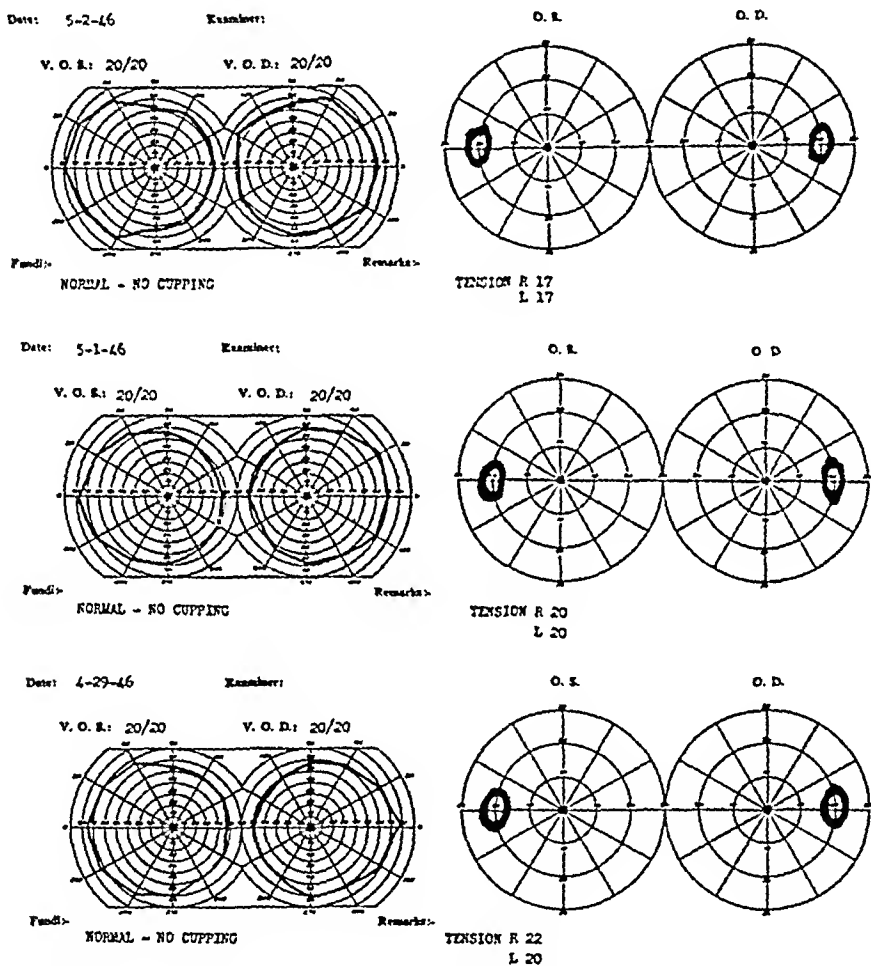


Fig. 9 (Grant). Enlargement of blindspot in three patients with symptoms of glaucoma, but with normal tension.

cases show enlargement of the blindspot with normal tension:

Case 4. J. P. K., a white woman, aged 64 years, was first seen January 19, 1945, with acute congestive glaucoma of the right eye. Symptoms simulating an acute rise in tension had been present since May, 1944. Vision: R.E., 10/200; L.E.,

did not reveal evidence of increased pressure at any time. The blindspots on January 31 were 2-2-45, 6-14-45, 8-6-45.

Case 5. McK., (14,311), a woman, aged 56 years, reported for examination in November, 1945. The corrected vision was: R.E., 20/20; L.E., 20/20. Tension before mydriasis was R.E., 20 mm. Hg;

TABLE 1
AN ANALYSIS OF 33 CASES OF EARLY GLAUCOMA

Number and Initials	Sex and Age	Vision		Tension No Pilocarpine		Tension With Pilocarpine		Fundi
		R	L	R	L	R	L	
14,385 F.S.	F 75	20/25	20/25	28	28	20	20	No cupping. First degree vascular change
3,090 L.R.	F 48	20/20	20/20	38	38	24	24	No cupping
13,971 M.S.	F 65	20/25	20/25	38	24	20	20	No cupping
9,023 L.B.	F 40	20/20	20/20	33	24	20	20	No cupping
10,067 R.S.	F 55	20/20	20/20	33	24	24	24	No cupping
14,048 F.J.	F 53	20/20	M.O.	33	33	20	24	No cupping. Chorioretinitis left eye, central
1,291 M.T.	F 58	20/20	20/20	33	28	24	24	No cupping. Lens opacities. Nuclear sclerosis
14,012 M.F.	F 55	20/20	20/20	33	33	26	26	No cupping
14,536 M.A.	F 49	20/20	20/20	38	33	24	24	No cupping
416 J.B.	M 46	20/20	20/20	26	26	20	20	No cupping. First degree vascular change
14,418 F.T.	F 49	20/20	20/20	33	17	20	17	No cupping
4,950 B.S.	F 70	20/20	20/40	33	33	24	30	No cupping. Second degree vascular change
2,642 F.G.	M 47	20/20	20/20	38	24	20	24	No cupping
10,714 C.B.	F 52	20/20	20/20	33	26	20	20	No cupping
14,167 G.B.	F 68	8/200	20/20	33	33	28	26	No cupping. Retinitis of hypertension third degree right eye
5,316 F.T.	F 50	20/20	20/20	28	28	20	20	No cupping
8,356 H.B.	M 57	20/20	20/20	33	17	17	20	No cupping. First degree vascular change
5,392 F.C.	F 59	20/20	20/20	38	28	26	26	No cupping. First degree vascular change
6,136 F.M.	F 72	20/30	20/30	38	24	20	20	No cupping. Marked nuclear sclerosis
14,782 W.C.	F 60	20/20	20/20	33	33	28	28	No cupping. Second-degree vascular change
14,910 C.J.	M 48	20/20	20/20	28	33	24	24	No cupping
3,400 J.O.	F 45	20/20	20/20	52	50	20	20	No cupping
3,020 L.R.	F 57	20/20	20/20	38	26	24	24	No cupping
10,983 J.R.	F 46	20/20	20/20	38	17	20	20	No cupping
5,515 W.S.	F 58	20/20	20/20	33	26	20	20	No cupping. First degree vascular change
10,013 E.S.	F 73	20/20	20/30	33	28	20	17	No cupping
12,511 T.W.	F 60	20/20	20/20	28	28	20	20	No cupping
13,563 C.R.	M 66	20/20	20/25	30	33	14	14	Cupping both optic nerves
12,746 J.K.	F 64	20/20	20/20	55	28	20	17	Acute glaucoma right eye Shallow chamber left eye
14,311 W.M.	F 56	20/20	20/20	24	20	17	17	Acute glaucoma right eye Shallow chamber left eye
5,300 B.L.	M 60	20/20	20/20	17	17	17	17	No cupping
9,600 H.M.	M 43	20/20	20/20	17	17	17	17	No cupping
14,212 E.D.	F 45	20/20	20/20	20	17	16	13	No cupping

L.E., 20 mm., and after mydriasis: R.E., 24 mm. Hg; L.E., 20 mm. Five-percent pilocarpine was then instilled in each eye. The following morning there was pain and blurred vision in the right eye which required surgery for the control of the tension. Vision was ultimately 20/20

with some reduction of the visual field. During her stay at the hospital, the tension of the left eye was normal throughout the 24-hour period and was never found to be elevated. There had, however, been symptoms suggestive of an acute rise of intraocular pressure. The cham-

ber was slightly shallow and a definite enlargement of the left blindspot was noted on discharge from the hospital, and the highest tension recorded has been 20 mm. This enlargement has persisted in spite of the use of pilocarpine twice daily.

COMMENT

Of the chronic noncongestive type of questionable glaucoma, three cases are here presented. The ages of the patients were 43, 45, and 59 years. All complained of fatigue with adequate correction of the refractive error. In two there was unequal accommodation, and in the other the accommodation was a very low normal. All three had enlarged blindspots, normal tension, and normal fundi. All three were very definitely improved with 1-percent pilocarpine used twice daily and were very willing to continue because of the relief obtained. The enlargement of the blindspots is characteristic of the group with increased tension, and the two with shallow anterior chambers. No change has been noted in the size of the blindspot in the course of a few months' treatment.

There are many questions. Is this a glaucoma with changes due to low pressure? Are the changes in the blindspot due to pressure? Has the tension been elevated above normal at some previous time? These questions can only be answered by long-continued observation and study.

SUMMARY

The following cases are presented: An analysis of the enlarged blindspot in 27 cases of early glaucoma without cupping of the optic nerve or peripheral field changes. A case of slight cupping of the optic nerve with increased tension found on only one occasion in the early morning with characteristic changes of glaucoma. Two cases of acute congestive glaucoma, with shallow anterior chamber in the fellow eye, with normal tension and an enlargement of the blindspot. Three cases of enlarged blindspot in persons with symptoms suggestive of glaucoma, without evidence of increased intraocular pressure. Study of the blindspot is a valuable aid to the study, progress, and diagnosis of early glaucoma.

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THE DISSATISFIED REFRACTION PATIENT*

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Study of the physical laws of refraction is an exact science. A less scientific procedure is the estimation of errors of ocular refraction. In this act, colloquially and ungrammatically referred to as "refracting a patient," the introduction of the subjective element involves fallibility. In the main, the objectives of clinical refraction are: (1) improvement in visual acuity, in which case the result of subjective improvement can be expressed by an objective formula; and (2) the relief of completely subjective symptoms. In the last instance the prescribing of corrective lenses becomes an art entailing its proper modicum of woes.

As practitioners of medicine our obligation to the patient is not fulfilled until he is relieved of his symptoms and satisfied in his own mind. The mere issuance of a written optical formula accompanied by certain brief instructions may possibly result in a cure; but this discussion concerns itself with the patient who is still unhappy and occasionally belligerent. Let us treat the patient as an ill individual; not merely compensate for his refractive error. We are, let us hope, physicians, not physicists.

On the lower plane of economics these patients deserve special consideration. A loquacious and dissatisfied patient does one's practice considerable disservice, especially in smaller communities. It is business folly to refuse to see these people or to brush them off with a curt statement that "your glasses are correct and you will have to get used to them."

In actual practice the receptionist and,

embarrassingly, those in the reception room are the first to hear of one's failure. The receptionist should receive the news sympathetically and diplomatically usher the patient to more secluded surroundings. Here he may be allowed to cool off, but not too long, for he may be irked by delay.

The complainant frequently begins with a deluge of generalities, sometimes highly seasoned with maledictions for the glasses and opprobrium for the doctor. On receiving the patient in the consulting room, it is my practice to give him ample time to relate his woes, and I list each one. This conversational catharsis tends to relieve antagonism as well as to define specific difficulties which may be explained or corrected.

BLURRED VISION

In any complaint the first procedure is obviously to check the lenses for agreement with the prescription. This has presumably been done before they were worn but errors do occur, especially reversed axes, reversed lenses, and less frequently a totally strange correction. If the lenses are correct and the complaint is lack of visual acuity, especially if the patient claims to see better with his former correction, find out if this is so and at what distance. Not infrequently a sense of strangeness is interpreted as blurring and, if improved vision can be demonstrated, the complaint is resolved. If the vision is definitely less than when the glasses were prescribed, assuming no ocular disease, there is obviously an error. With lenses prescribed under mydriasis a further reduction in sphere may be necessary, or the axes may have

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shifted, especially if the cylinders be of high degree. Too much spherical correction is more frequent with high hypermetropia, but can occur with corrections of less than $+1.00D.$, and also in low minus corrections. One patient accepting $-2.00D.$ at 6 meters found his vision for bowling impaired until another quarter was deducted. Shifting of axes after mydriasis is frequent. Both these difficulties could be avoided by routine post-mydriatic tests, but the delay, in patients living at a distance, is prohibitive.

A discrepancy between the location of a focal plane in the trial frames and the finished glasses may cause blurring with high corrections. A clue to this is furnished when the patient either pulls the glasses down on his nose or pushes them nearer his eyes to improve his vision. This is particularly true in aphakia or very high myopia. A young woman for whom I had prescribed $-18.00D.$ had to be increased to $-19.00D.$ because I had placed the test lenses too close to her eyes, resulting in undercorrection. When using high spheres, it is essential to consider which cell of the trial frame is used.

A not infrequent complaint is that the formerly better eye is now the worse eye. If, with the former correction, the vision in O.D. was 6/9 and in O.S., 6/15, and on refraction the right eye was unimproved and in the left eye 6/7.5 was obtained, the patient feels there is something wrong. An explanation of the pathologic processes will usually satisfy the patient. In intumescence of the lens, a similar complaint results when the distance acceptance is toward the minus side, thus making the reading focus more remote. The myope, especially if presbyopic, will often complain of reading difficulties if the strength of the distance correction is increased.

Often we hear the statement: "I could see all right without glasses until you

gave me these." The explanation is either that accommodative strain has been relaxed or the patient is approaching presbyopia, or a change of occupation is entailing more accurate vision. It is with difficulty, however, that one can convince the patient that the glasses have not "weakened" his eyes.

All cases of blurring are not the fault of the recently prescribed lenses. In two instances, both women, one presbyopic and one younger, the complaint was inability to read with the new glasses. The disability was real. They both required addition plus. There was a marked weakness of accommodation, in the first instance due to "nerve medicine" containing hyoscine, and in the second to gastrointestinal therapy containing atropine.

CLERICAL ERROR

If none of the above be applicable, it is necessary to suspect a clerical error. It is a great help to have a record of a previous refraction. If the patient is new to me I always neutralize his old lenses, both to avoid putting him to the expense of duplication and to find with what correction he has been unhappy. Even with assiduous attention to accuracy the human mind plays tricks especially under pressure. Mental transpositions can occur; for example, in recording axes, transposing 15° to the right of the vertical to 15° to the left of the vertical, thus recording 105° for 75° , or similarly with a horizontal axis; or transposition of the intercardinal axes. A substitution of the wrong sign should be easily found if it occurred in transcription. If it is in the original record, a comparison with former corrections furnishes the clue. If there be no former record, it is necessary to repeat the refraction. Clerical errors can cause the omission of a figure, axis 135° being recorded as 35° , or an incorrect figure in transcription such as a hastily

written 5 being read as an 8. In one instance, I discovered a $+1.75D$. add in a person 75 years of age. Obviously, I had meant a $+2.75D$. In dictation, a figure may be miscalled or misunderstood. In recording from the trial frame when more than two lenses are used, one may be overlooked. The most grievous error I have ever encountered was a reversal of 4 degrees of vertical prism! This was discovered by comparison with previous corrections.

Blurring, of course, can arise from ocular disease. The patient is usually aware of corneal opacities as they have resulted from antecedent disease or injury. Lenticular opacities, cloudy vitreous, or macular degenerative changes require explanation, and it is often difficult to convince the patient that the fault is not remediable by different lenses.

ADJUSTMENT

Passing now from blurring to discomfort, the first step is to check the adjustment of the glasses. The interpupillary distance and the optical centers must correspond, with proper decentering for reading corrections. There must be vertical compensation for facial asymmetry, and the difference in level of the lenses must be accomplished without rotation of axes. In high corrections it is useful to check the adjustment of the finished glasses by the Maddox rod with horizontal image. In high cylinders I have found it useful to check the axis of the finished glasses with the cross cylinder. Minute degrees of rotation which cannot be measured on the trial-frame scale will result in comfort or discomfort. I have the optician come to the office and make repeated checks until the point of equality is found.

Some persons are more comfortable with an incorrect P.D. One hypermetropic person with high esophoria is comfort-

able only with the lenses decentered in. This gives the effect of base-in prisms which theoretically should increase discomfort, but does not.

Complaints based on obvious mechanical difficulties we will pass over. Comfort and convenience are often increased by raising, lowering or tilting the lenses. The latter is especially true in bifocals. If, on looking down, the reading segment is progressively farther from the cornea the effective strength of the lens is increased, causing blurring or an inconveniently short focus. This is obviated by tilting the lower edge toward the face so that the radius of the eyeball plus the distance from corneal center to lens becomes an approximate constant.

Complaints of distortion, horizontal lines having a curve, the table or street not being level, the sensation of feeling too tall or too short and stepping too high to clear the curbstone are familiar to all of us. They are due to unaccustomed degrees of correction, unfamiliar cylinders, or spherical aberration through the periphery of lenses. Explanation and time resolve these difficulties.

Anisometropia entails difficulties. An obviously impossible combination should not be prescribed. The possibility of discomfort can often be foreseen and, if the patient is forewarned, a subsequent necessary reduction in strength of the offending glass presents no embarrassing difficulties.

REFLECTIONS

Reflections cause bitter complaint from some individuals. This is especially frequent with low minus corrections, where the total spherocylindrical strength is within $0.50D$. or $0.75D$. I have tried various transpositions without benefit. Recently the Balcote film has become available for civilian use. This reduces the reflected light from approximately four

percent to less than two percent and affords some measure of relief. I have not had an opportunity to try it in those individuals who complain of four headlights on an approaching car gradually merging to two.

MUSCLES

Discomfort from disturbance of the accommodation-convergence reflex is common. An increased plus correction either for distance or near entails a relative increase in convergence and relaxation of accommodation, and conversely an increase in minus entails more accommodation with no increase in convergence. This is more frequent in the farsighted person or presbyope and is especially marked with convergence insufficiency. Time will often adjust matters and explanation helps the patient's state of mind. If convergence insufficiency is present, appropriate exercises are of great help. In an occasional case I have prescribed prisms base in for close work, but this is without remedial virtue and should be avoided if possible.

If vertical prisms have been prescribed, there may be overcorrection because the finding was temporary, possibly due to vertical maladjustment of former lenses, or because the measurement was made with maladjusted trial frames. If the Maddox rod shows overcorrection in the finished glasses the prism must be reduced or eliminated. The patient may be wearing the glasses intermittently and he may experience confusion each time they are put on or removed. The vertical muscle imbalance may not be concomitant so that the prism is incorrect for certain frequently used directions of gaze. Latent muscle imbalance may be present to be revealed by cover testing. Several times I have found the covered eye to turn up whichever it be; that is, right hyperphoria manifested by occluding the right

lens and left hyperphoria by occluding the left lens. Unless the hyperphoria remains on the same side with either eye occluded, I do not use a vertical prism.

PRESBYOPIA

Presbyopia entails its peculiar pitfalls. In the incipient presbyope it is essential to avoid bifocals until they are necessitated by the conditions of ocular use of the particular individual. An addition for near may be of comfort for prolonged close work but a bifocal for constant wear will not be satisfactory if there be not a distinct improvement in visual acuity with the lower segment. A bifocal is a crutch. He who can walk without a crutch will not use one. There must be sufficiently distinct improvement for the aid to be appreciated. In this regard, housewives are a particular stumbling block. I make it a custom, with infrequent exceptions, not to prescribe bifocals until housewives cannot see the print in the telephone book. By that time it is a nuisance to run upstairs for the reading glasses and all is well.

The focal distance of the addition for near must suit the patient's occupation and, of course, the older he is the more important it is to place the remaining accommodative range at the most serviceable distance. Stenographers want to see their copy, see the typing and still read at a reasonably (or unreasonably) close range. Carpenters want to see their thumb on starting a saw and the far end of the board, and still have clear vision at infinity and for reading. Music teachers want to read, play the piano, stand behind their pupils, and still have the piano score clear. Violinists want to read music on a distant stand and see the conductor. A lumber grader achieved relative comfort from trifocals. Timber cruisers have to be able to see their notations but are bothered by the lower segment when

walking a rough trail. Store clerks complain that they have to stoop to write sales slips and can't see the price tags on shelves through the upper segment. A similar difficulty exists for postal employees sorting mail. Dentists work at a very close range. Otologists must have a segment that will come behind the head mirror aperture. A refractionist must be able to see the trail frames without tilting his head back and an ophthalmic surgeon must have acute vision at his customary working distance.

This is all related to the most frequent complaint arising from bifocals; namely, blurring in the intermediate distance which increases with each successive increase in aid. Some patients are satisfied with an explanation. Many require a careful analysis of the various conditions of their ocular work. The difficulties can be met by segments of different heights, separate glasses for specialized purposes, or, less frequently, by trifocals. It takes time to analyze the person's needs and to evaluate his personality. It takes ingenuity to solve some of the more complicated demands. Starting with the premise that glasses can be made to give clear vision at any given distance and direction of gaze a solution can usually be found. Sometimes the patient does not have the adaptability or stamina to accustom himself to the prothesis.

The most common mistake is to overcorrect the presbyopia. Despite assiduous care and a constant awareness of this danger it still happens. When encountered, unless it is due to lack of tilting as previously mentioned, admit the fault, smile charmingly, commiserate with the patient, and obtain new lenses. It is more likely to happen when the acceptance for 6 meters shows increased plus and the addition for near is also stepped up. For example: A patient has been wearing +1.50D. with a +1.50D. add, making a

total of 3.00D. He now accepts +2.00D. for distance and being older you increase the add to 2.00D., making a total of +4.00D., and he finds the reading distance too close. When the plus acceptance for distance increases, the patient may be comfortable with no increase in the addition for near.

On the other hand, with lenticular intumescence the patient has frequently accustomed himself to read at 9 or 10 inches. With an increased minus lens for distance and an addition appropriate for his age allowing him to read at 14 inches, he is dissatisfied. These persons desire excessively strong lower segments, particularly if lenticular opacities are present, in order to obtain a larger image.

Inequalities in accommodation will account for some complaints and should be compensated. In a unique instance, in incipient presbyopia without discoverable organic disease, to explain a unilateral accommodative weakness I prescribed reading glasses with a unilateral addition and achieved success.

Some patients will complain of blurring across the room. They have become accustomed to clear vision at this distance by wearing an overcorrection for infinity. They are happier with an extra quarter or half diopter in the upper segment even though it blurs somewhat at the horizon.

Elderly persons with lenticular opacities sometimes expect miracles. With the old glasses they may have had only 6/15 vision and with the new, 6/9+, but they are dissatisfied that the visual acuity of youth is not restored. To explain is simple; to make them contented is difficult, especially if complicated by the hard-headedness of cerebral arteriosclerosis.

Occasional persons will not persevere with cylinders until they are unconscious of them. This is particularly true of the advanced presbyope who is wearing glasses for the first time. It is sometimes

better to remove the cylinders at the sacrifice of some visual acuity, and it is always better to do so before a smart competitor does it for you.

Rapid changes in refraction may be due to glycosuria but there is an occasional patient of advanced years who will accept radically different corrections on repeated examination. The first having proved unsatisfactory, the individual returns, and after the usual sleuthing, you repeat the examination with a markedly discrepant result. I have recently been a near candidate for commitment because a woman, aged 72 years, would vary in the left eye from a minus 0.5D. cylinder to a plus 1.00D. cylinder with the axis ranging from 180° to 45° . The prevention is repeated refraction before prescription. The solution is to give the weakest possible cylinder with which good vision is obtained. The final axis is probably an approximation but will be more accurate if testing be intermittent and not pressed to or beyond the point of fatigue, and will be progressively less important as the cylinder is reduced.

SPECIAL PROBLEMS

Aphakia presents its special problems. In monocular aphakia, comfort can be increased by occluding the less serviceable eye with a frosted glass or black paper. The absence of accommodation (with very rare exceptions), the necessity of thick lenses, and the consequent aberration combined with the age of the patient require considerable stamina and adaptability and frequently much explanation on the part of the physician. I believe many persons are happier with visual acuity of 6/12 and 6/45, with binocular vision and an ordinary correction, than with 6/6 or 6/5 and monocular vision with a thick lens. For this reason (and others) I do not rush into extraction of partially cataractous lenses. One

bilateral postoperative cataract case complained of both vertical and horizontal diplopia after the second eye was corrected. The vertical error was relieved by proper adjustment of lenses and the horizontal by convergence exercises.

A few unique situations deserve special mention. A letter from a patient wearing bifocals stated he could not see bulletin boards. Correspondence failed to clarify the difficulty. When he returned to the office, the situation was this: He was deformed with spinal arthritis so that his head was inclined forward. In order to bring his eyes to bear on the bulletin board he had to lean back against the opposite wall. This placed the bulletin board in the intermediate blurred area. The difficulty was resolved by a pair of "fit-overs" of the proper focal distance.

Another patient has a slight paresis of the left external rectus, due to which he is accustomed to hold his head slightly rotated to the left. He had never been able to wear bifocals with comfort. By decentering each lens one millimeter to the right he was relieved.

A patient, with an inferior surgical coloboma of the left eye resulting from trauma, was bothered by dazzling. He had no discomfort in the uninjured eye. A prescription incorporating a clear lens for the normal eye and a No. 4 soft light for the injured eye gave relief.

NONREFRACTIVE ASTHENOPSIA

Improper lighting explains some cases of persistent complaint. Fluorescent lighting is particularly at fault, less so now, but it is far from perfect. Insufficient or excessive light in relation to the work performed may be the cause. Sufficient light for reading is insufficient for drafting, or picking flaws in metal specimens, or sewing black cloth with black thread. Excessive light may be tiring. Concentrated, circumscribed illumination

may cause "spotlight fatigue." According to Ferree and Rand, an extreme contrast of 1:50 is the limit of tolerance. I believe it is lower. Glare may be direct, reflected, or due to improper relation between source and object. Complete search for the abstruse causes of asthenopia should include a survey of the patient's environment with a light meter. This is, of course, impracticable.

Systemic disease may be the answer. Ocular function requires muscular activity and any systemic fault which lowers muscular tone, from anemia to myasthenia gravis may produce asthenopia. Close work in excess of the individual's capacity may produce simple fatigue. The menarche and menopause cause a manifestation of symptoms otherwise disregarded. A child may have psychologic reading or writing problems unrelated to refraction error. There may be vitamin-A deficiency. Nasal congestion, obstruction, or sinus infection may produce symptoms indistinguishable from refractive asthenopia.

Or there may be aniseikonia. I mention this to avoid the criticism of omission. I am unable to distinguish the symptoms of this disorder from those arising from refractive error or muscle imbalance, and am geographically located so that I have no experience therewith.

GENERAL REMARKS

It is true that some persons do not have the stamina to accustom themselves to glasses. They have similar difficulty with dentures, wooden legs, crutches, and new shoes. There is a little of this trait in all males who love to hang on to an old hat. However, it is easy to label the patient neurotic or neurasthenic and this should never be done without exhaustive investigation. Even then I would rather consider him hypersensitive. I believe it has been established that some individuals ac-

tually feel more pain from a given stimulus than others. Aesthetically it is certainly true that some individuals are offended by inharmonious colors more than others. In the realm of sensory stimulation, but at the other extreme, some people live in contented symbiosis with pediculi while others are much disturbed by the stimuli of these "poor weak timorous beasties." Or consider the classical example of the man in bed New Year's morning, suffering from postimbibition syndrome and cringing from the raucous cacophony of the kitten stamping across the Persian carpet. My point is that we must consider the threshold of pain or discomfort in a given individual, seek out any discoverable cause by exhaustive search, and correct it if it be remediable, before we consign the patient (with private imprecations) to a life of travail wandering in an ever widening orbit from refractionist to refractionist.

Many causes of dissatisfaction can be obviated at the original examination. There is occasionally an obvious clash between the personality of the doctor and the patient. I know of one instance where a difficult female was taken aside by the office nurse and told, "Oh, please don't make doctor angry; it upsets him so!" Obviously, she never thought she had been properly refracted. The tempo of the refraction must be adjusted to the patient's ability to perceive difference and his reaction time. It is unwise to rush a person without training in visual distinction. It is easier to refract a surveyor or a microscopist than a chef. It is quicker to refract a Latin than a Scandinavian. Some persons apparently can't perceive a difference of a half diopter. Others can split an eighth and consistently estimate an axis to 0.5 degrees. Some patients are obtuse and indifferent and fail to register gross differences. Others are apprehensive, afraid of giving inconsistent an-

swers, and can always find a difference between a $+0.12D$. and a $+0.12D$. To avoid later complaints assure the patient of the correctness of his answers. Adjust the tempo of the procedure to the reaction time of the patient. Create no impression of hurry. When the prescription is given, foresee as many difficulties as possible due to any of the reasons touched upon in the foregoing and life will be a little smoother. And if the patient returns dissatisfied, accord him every courtesy and all the facilities at your command to restore him to health, which means, by one definition, to put him in perfect accord with his environment.

SUMMARY AND CONCLUSIONS

1. The dissatisfied refraction patient deserves our time to hear his complaints.
2. Usual and unusual causes of complaint are grouped and discussed.
3. Every effort should be made to locate the difficulty and correct it.
4. A patient explanation of irremediable difficulties should be made.
5. The obligation of the refractionist is not discharged until the patient is comfortable in his eyes and contented in his mind.

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PROCEEDINGS OF THE ALL-INDIA OPHTHALMOLOGICAL SOCIETY

SESSION 1945, VOLUME 8

This report contains the transactions of the scientific sessions, minutes of meetings, and membership lists. The first part of the program was a symposium on glaucoma dealt with by six writers from the point of view of etiology, symptomatology, treatment, the Bengal epidemic of dropsy glaucoma, and gonioscopy. Epidemic dropsy glaucoma is one of the main ocular complications of epidemic dropsy. It was first recognized by Maynard in Calcutta in 1908. The incidence increased greatly until 1935. It is a primary chronic noninflammatory glaucoma.

The topics of the other 23 papers on the program are as varied as one would expect when a large number of ophthalmologists with varied interests and practices convenes. Some papers are case reports and are strikingly brief. Several deal with experience with sulfa drugs. A discussion on tuberculin therapy by S. N. Cooper is one of the longer essays. The author gives a comprehensive and thorough analysis of the essentials of our knowledge of tuberculin. He favors the therapeutic use by desensitization and states that "the eye, being an organ which exhibits the immune-allergic reaction easily, is a very sensitive balance to watch the reaction of tuberculin and for determining the dosage required for desensitization."

F. H. Haessler.

NOTES, CASES, INSTRUMENTS

BILATERAL OPHTHALMOPLEGIA IN ACUTE ANTERIOR POLIOMYELITIS*

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The case to be reported is of unusual interest since it is a description of a rare condition; that is, bilateral complete ophthalmoplegia in acute anterior poliomyelitis.

Paralysis of the extraocular muscles in acute anterior poliomyelitis is not uncommon. Sautter¹ found that 19 of 669 cases of this disease exhibited symptoms of paralysis of one or more extraocular muscles. He stated that Medin found 9 cases of paralysis of one or more extraocular muscles in 64 cases of the disease; Wickman found 22 isolated cranial nerve palsies and 34 combined cranial and spinal nerve palsies in 862 cases; Leegard reported 2 cases of facial palsy, 3 cases of extraocular muscle palsy with spinal symptoms and one of ptosis with spinal symptoms in 311 cases; E. Mueller in 100 cases found 13 palsies and 3 unilateral abducens palsies.

In the New York epidemic of 1907,² an analysis of 752 cases showed 27 facial, 18 lid palsies, and 26 cases of strabismus. Emmons² found in 70 cases of the disease 7 cases of extraocular muscle paralysis and concluded that as a safe average, 10 percent of cases of acute anterior poliomyelitis show symptoms of paralysis of the extraocular muscles.

Ophthalmoplegia in acute poliomyelitis is, however, very rare. Sautter¹ recorded one case of bilateral ophthalmoplegia externa with ptosis in the left eye. Posey and Swindells³ reported one case of com-

plete bilateral external ophthalmoplegia in this disease. They cited Wickman as reporting a case from the Vienna epidemic of 1909, in which there was ophthalmoplegia with preservation of convergence, and they cited Takahashi as reporting a similar case from the same epidemic, and Ut-hoff as having seen one case of external ophthalmoplegia in acute anterior poliomyelitis.

Emmons² did not report such a case in his series. Hall's case⁴ did not exhibit ophthalmoplegia. Ghormley⁵ does not mention it in his series of 125 cases, but he was primarily concerned with optic neuritis. Somerset,⁶ writing on the various causes and clinical manifestations of ophthalmoplegia externa, does not mention poliomyelitis although he cites a case of conjugate deviation with ptosis which he considered due to an old encephalomyelitis. Poe⁷ described a case of ophthalmoplegia totalis, but concluded it was congenital in origin.

Reference to this symptom complex in textbooks of ophthalmology or neurology is scanty and not very illuminating. Acute anterior poliomyelitis is mentioned as a possible cause of ocular-muscle palsies by Peter.⁸ Berens⁹ mentions Wernicke's superior polioencephalitis as a cause of ophthalmoplegia, but Emmons² believes this is not an entity but is in reality infantile paralysis. Rea¹⁰ states that acute nuclear paralysis is due to an acute inflammatory process in the nuclei resembling that which produces poliomyelitis, or to hemorrhagic lesions. In his description of the ocular effects of acute poliomyelitis, ophthalmoplegia is not mentioned. Wechsler¹² does not mention ophthalmoplegia in poliomyelitis.

The pathology of acute poliomyelitis is better known. Charcot¹⁶ was apparently

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the first to appreciate the significance of the anterior horn-cell degenerations, and his hypothesis of the organic lesion of poliomyelitis has, since 1941, challenged the ingenuity of all students of the pathology and pathogenesis of this disease. Roth¹⁶ thought the essential lesion was primarily an interstitial myelitis originating in the glia and the vessels. Rissler's work¹⁶ showed both changes simultaneous and dependent.

How does it happen that many apparently severe paralyses in the acute stages later recover good function? Flexner and Amoss¹⁶ answered this when they stated: "There are good grounds for believing that a considerable part of the paralyses, especially those that are not permanent, are the effect of temporary vascular impediments. The impediments are all outside the lumina of the vessels which are merely reduced in caliber through pressure; thrombi do not occur. Some of the functional disturbances are possibly, thus, anemic in origin; others are probably caused by slight degenerations and still others are undoubtedly caused by focal hemorrhages and edema. All these effects may, possibly, be recovered from; part by isolation of the cellular vascular infiltrate and re-establishment of the lumen, part by absorption of the edema and hemorrhage, and part by restoration of the mildly degenerated nerve cells. The severer degenerative and other lesions, through which actual necrosis is produced, do not become restored."

Hassin¹³ gives three features of the disease; namely, exudation, alteration, proliferation. The exudation is represented by perivascular infiltrations, the alteration by ganglion-cell degeneration, the proliferation by progressive glial phenomena and nodule formation. The morbid changes may extend throughout the entire central nervous system and become a disseminated condition.

In the early stages, the anterior horns are swollen, areolar, and vacuolated; in severe cases, there may be foci of necrosis and hemorrhages. The ganglion cells show



Fig. 1 (Wright). (A) Eyes front showing a slight divergence. No motion was observed on attempting vertical movements. (B) Attempting to look to the left. The right medial rectus was the only muscle functioning, and its action was paretic.

chromatolysis, tumefaction, and invasion by phagocytic elements. In other cases, they are merely surrounded by satellites but not invaded. The ganglion cell may disappear within 24 hours. Glial cells increase enormously in number; both oligodendroglia and microglia. Parallel with the ganglion-cell destruction and glial changes are demyelination of white fibers of the anterior horns. In advanced cases both axone and myelin are replaced by glia. This also occurs in the anterior roots. The entire lower motor neuron succumbs in a short time.

Independent of these parenchymatous changes are changes (mesodermal) in the meninges and blood vessels. There is hyperemia and round-cell infiltration, mainly of lymphocytes, and, later, plasma cells and polyblasts. These cell bodies are con-

lined to the Virchow-Robin spaces but in severe cases may invade parenchyma.

Although as a rule the changes are confined to the cord, in epidemics or severe forms the clinical picture may assume the ascending or descending type of Landry's paralysis with marked involvement of the medulla, pons, mesencephalon, basal ganglia, and even cortex. The condition may be so marked in the cortex as to be histologically indistinguishable from epidemic encephalitis. Mesodermal and parenchymatous changes may not be parallel in degree but are independent phenomena due to the same cause. Localization of lesions in poliomyelitis and epidemic encephalitis may be similar; that is, substantia nigra.

Wernicke's description of hemorrhagic superior encephalitis as given by Hassin¹³ shows hyperemia and neovascularization, degeneration of ganglion cells, and reactive glial proliferation mainly around the third ventricle. In some cases, the degenerative changes are found in the nuclei of the medulla and cranial nerves.

CASE REPORT

The following case report is that of a patient ill of acute anterior poliomyelitis during the epidemic that occurred in the Chicago area in the summer of 1946.

Miss M. R., aged 24 years, white, student nurse, entered the hospital on September 18, 1946, complaining of dizziness, diplopia, vicelike headache, and nausea. Slight nausea and dizziness had been present for five days prior to admission, but diplopia occurred on the day of admission. The preceding summer she had had intermittent headaches and nasal stuffiness, and a diagnosis of hay fever and upper respiratory infection had been made. Three weeks prior to admission she had had a severe upper respiratory tract infection, but went on a visit to Canada. On returning she began to notice the symptoms given above.

Examination showed, on admission to the hospital, enlarged cervical glands, neck somewhat stiff, with pain elicited on its movement; tonsils large and inflamed. The pharynx was inflamed and showed hypertrophied lymph follicles. Lungs showed moderate increase in breath sounds bilaterally and resonant percussion. Abdomen showed a right, lower-quadrant scar and no tenderness nor rigidity. Reflexes were: Abdominals present, biceps and triceps equal but diminished, knee and ankle jerks active and equal. Temperature was 103° F.; pulse, 120; respirations, 24.

Ophthalmic examination revealed no nystagmus. Both eyes were deviated outward, although the left eye deviated less. Each eye retained a weak power of external rotation and could make feeble vertical movements when abducted. Convergence was absent, but there was still some activity of the medial recti since on covering alternate eyes the uncovered eye swung back from abduction to fix near the midline. Both pupils were small but responded feebly to light. The patient could not read 12-point type at any distance.

Spinal fluid findings were: Total protein 86.8 mg.; W.B.C. 58 (60 percent lymphocytes; 40 percent polymorphonuclear leukocytes). Five days later the spinal fluid findings were the same plus a negative Kahn and a gold curve of 1-1-2-2-1-000.

Nose and throat cultures showed *Staphylococcus albus* and *aureus*, diphtheroids, pneumococci, and *M. tetragenous*.

The blood count was: R.B.C., 4,730,000; W.B.C., 10,350 (with 71 percent filament neutrophils, 7 percent eosinophils, 1 percent basophils, and 21 percent lymphocytes). The urine was normal.

Six days later, bilateral ptosis was noted as well as weakness of the muscles of the

back and of the extremities. Two weeks after the onset, ophthalmoplegia was complete in both eyes and a left seventh-nerve paralysis had developed which resulted in inability to close the left eye. Voiding had also become difficult. The facial-nerve lesion then slowly regressed so that 2½ weeks later the patient could close the lids to within 2 mm. of each other. Six weeks after the onset of the disease, the right eye could be adducted 20 degrees and the left eye could be adducted 15 degrees and could hold fixation better than the right. Vertical movements were almost nil. Eight weeks after onset, the patient was suppressing in the right eye and fixing with the left, and monocular adduction had largely returned. Pupils had returned to normal and accommodation was sufficient to read 8-point type at 13 inches unaided. Convergence remained nil. A severe weakness of all muscles of both hands remained. Both deltoids and triceps remained paralyzed. There was left wrist drop and bilateral foot drop, worse on the left. Six months later the right medial rectus was functioning; the left medial rectus was paretic, and scarcely any motion had returned to the vertical muscles.

Convergence was nil and the wrist and foot drop remained severe.

The patient received a total of 2,820,000 units of penicillin, 12 gm. of sulfadiazine, and 1,350 cc. of convalescent polio serum.

COMMENT

The external recti, last of the extraocular muscles to become paralytic, were also last to show any improvement. Convergence was early lost and not regained. Recovery from internal ophthalmoplegia was rapid. The seventh-nerve palsy occurred two weeks after onset of the illness, but recovery was more rapid than that of the third-, fourth-, or sixth-nerve palsies. Diplopia was an early symptom and extraocular-muscle involvement was prominent, well in advance of spinal-cord symptoms.

SUMMARY

Although ocular complications of acute anterior poliomyelitis are not uncommon, ophthalmoplegia is rare. A case of bilateral complete ophthalmoplegia with left seventh-nerve palsy is presented.

606 North Brand Boulevard (3).

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METHOD FOR RESTORATION OF HUMAN ORBITS FOLLOWING NECROSCOPY ENUCLEATION*

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Detroit, Michigan

The field of keratoplasty and sight restoration is relatively new but in its short existence has attracted widespread interest. It is evident that the continued progress in this science depends, in a very great measure, upon the proficiency in obtaining eyes for pathologic study as well as for corneal transplantation.

It has been our experience while working with the Wayne University Eye-Bank, which was under the direction of Dr. Parker Heath, that the education of the public to give their eyes, at the time of death, depends to a large extent upon the assurance by the physician that the orbit will be restored to a normal outward appearance.

The object of this study is to present an approved, simplified technique for restoration of the human orbit. There will be no external evidence of alteration if the orbital cavity is prepared in accordance with the following procedure.

MATERIAL

Hemostat, cellulose cotton, sealer solution¹ ("Stix," Gold Crest Chemical Cor-

poration,[†] 1063 Jackson Avenue, Long Island City, New York), eye caps (Edward S. Butler Company, 33 Otolaya Terrace, San Francisco, California), are the materials needed.

PROCEDURE

The first step is to control the leakage from the terminal branches of the ophthalmic artery as they enter the orbit through the narrow apex of the muscle cone. This is accomplished by thoroughly crushing the tissue at the apex of the orbit with the aid of a hemostat. The optic nerve will also require crushing if it has been severed near the globe.

The capillary type of leakage is adequately controlled by sealer solution which is applied with cotton in a thin film over the orbital walls and permitted to dry. This is sufficient to seal the vessels and to withstand the usual pressure of injection of embalming solution.

The remainder of the orbital cavity is then filled with a cotton ball of suitable size followed by insertion of the eye cap. (The author wishes to acknowledge suggestion and aid given him by the Department of Mortuary Science, Wayne University, Detroit.)

1512 St. Antoine Street (26).

[†] References are made to commercial manufactures for the sole purpose of giving information as to sources of supply of material. There is no intention of implying that other commercial sources are not equally satisfactory.

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BLACKBOARD CORNEA FOR TEACHING

ANDREW DE ROETHH, SR., M.D.
Spokane, Washington

The teaching of clinical ophthalmology is rather handicapped by the small size of the eye. When not a few individuals but a whole class has to be instructed, the use of the blackboard, slides, or moving pictures is imperative. When pathologic conditions of the anterior segment have to be demonstrated on the blackboard, one is handicapped by trying to draw on a plane, that is in two dimensions, conditions which are three dimensional.

To overcome this difficulty, a blackboard cornea for teaching purposes was devised. This is a cornea made of plastic material.* The measurements are 15 times the size of a normal-sized cornea, except in thickness. This gives a horizontal diameter of (15 by 11.75 mm.) 17.6 cm., a radius of (15 by 7.7 mm.) 11.5 cm. The scleral overlapping at the upper and lower limbus is indicated by a frosted crescentic portion 12-mm. wide at the 12- and 6-o'clock positions. The thickness of the blackboard cornea is only 3 mm. instead of (15 by 1) 15 mm., to make it light.

When demonstrating a condition of the anterior segment of the eye, a circle is drawn around the border of the cornea while this is held against the blackboard. The cornea is then removed, and the iris and pupil and the pathologic condition under discussion are marked on the blackboard. The cornea is fastened against this drawing with a 3.75-cm. (1½-inch) wide piece of Scotch tape placed across its upper edge. This makes it possible to lift the cornea by its lower edge if further draw-

ing is necessary in the iris plane or on the posterior surface of the cornea. Now the pathologic condition of the cornea can be marked. Grease pencils of different colors have to be used, because chalk does not write on plastic. These marks can be removed with warm water and soap, or more easily and faster with cleaning fluid



Figs. 1 and 2 (de Roethh, Sr.). Blackboard cornea. Fig. 1. Large central corneal scar with superficial vessels. Pencil pointing to a vessel. Optical coloboma of the iris between the 3- and 4-o'clock positions. Fig. 2. Interstitial keratitis with two bundles of deep vessels. Dull corneal reflex due to epithelial edema.

(for example, energine) or plastic remover. The demonstration is more life-like on a white board or frosted glass.

Figure 1 shows a central corneal scar with superficial vessels. There is an iris coloboma at the 3- to 4-o'clock positions and a sharply outlined corneal reflex.

Figure 2 demonstrates interstitial keratitis with very dull corneal reflex and two bunches of deep corneal vessels which were drawn on the posterior surface of the cornea.

The blackboard cornea facilitates the demonstration of pathologic conditions of the anterior segment. In addition to this cornea of plastic material, colored grease pencils, 1½-inch wide Scotch tape, and cleaning fluid (engrine) to remove the markings are all that are needed to operate it.

Old National Bank Building (8).

* Plastic Modern Company, Spokane, Washington.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

COLORADO OPHTHALMOLOGICAL SOCIETY

December 21, 1946

DR. GEORGE STINE, *presiding*

LEONTIASIS OSSEA

DR. EDNA M. REYNOLDS presented Mrs. C. B., aged 52 years, as a case of leontiasis ossea which is limited to the sphenoid bone on the right side. The patient gave a history of a severe fall at about the age of six years in which the right side of her face was struck against a curbing. There was no apparent deformity until seven years ago when she hit the right eye on the knob of a chair in leaning over to pick up papers off the floor. After this injury, the right eye became prominent. In 1940, she went to Colorado General Hospital because she found that she could not see with the right eye.

When she was first seen in July, 1944, the right eye showed proptosis with limitation of movement laterally. Measurement with the exophthalmometer showed 28 mm. for right eye and 19 mm. for the left. (The same readings were found at Colorado General Hospital in 1940.) Vision was reduced to light perception.

The vision of the left eye without correction was 20/15+ and the eyeground was normal. An X-ray study of the skull was made by Dr. Harmon Brandenburg, who made the diagnosis of leontiasis ossea. The X-ray report was as follows: "Primary involvement of the sphenoid on the right side, with lamination of frontal bone; closure of the sphenoid fissure and foramina including the optic, causing blindness of the right eye and pro-

tusion of eyeball due to enlargement and pressure from behind."

Leontiasis ossea is the name given to the condition of hyperostosis of the facial and cranial bones. The disease has also been termed megalocephaly and hyperostosis of the skull. Since there was no tendency to malignancy, no treatment was advised. In these patients there is a tendency toward slow healing, and in this case, there had been no advance in the condition in a 4-year interval.

The patient was seen again in September, 1946. At that time, there was no apparent change in her condition and X-ray pictures showed no advance in the condition. Enucleation of the right eye for cosmetic purposes has been considered but declined by the patient.

CAVERNOUS OPTIC ATROPHY

DR. R. W. DANIELSON presented A.M.K., a 73-year-old clerk, who had come to the office about a month previously complaining of failing vision in both eyes of several years' standing. He had been to an optometrist recently who was unable to improve his vision. He had had no pain or other symptoms of glaucoma. On examination, uncorrected vision of the right eye was 20/100, and of the left eye, 20/15. This could not be improved with correction. The media and fundi were normal except that there was a deep cup in the temporal four fifths of each disc. The lamina cribrosa was not plainly visible. There was no overhanging of the edges of these cups. However, the appearance of these cups was such that one would offhand have certainly made a diagnosis of glaucoma. The perimetric field of vision with a 3-mm. white test

object showed only a small strip near the point of fixation on the 180-degree meridian of the right eye. In the left eye there was an almost concentric contraction down to about 20 degrees. The tension on each eye was 20 mm. Hg (Gradle-Schiøtz) and, after dilatation with homatropine for two hours, the tension was still 20 mm. Hg in each eye.

The patient was placed on pilocarpine. The next day the intraocular pressure was 13 mm. Hg in each eye. This pressure was taken on several subsequent days and was never found to be above 20 mm. Hg, except on one day following a provocative water-consumption test when the pressure of the right eye rose to 24 mm. Hg. On this day, pilocarpine had not been used, the water test was repeated using pilocarpine at the same time. In this instance, tension of the right eye did not increase after consumption of large amounts of water, but tension of the left eye went from 20 mm. Hg to 24 mm.

This appeared to be a case of so-called low-tension glaucoma until it was finally decided to make an X-ray study of the patient's sella turcica. Surprisingly, the X-ray report revealed changes in that region probably secondary to meningioma. The case was referred to Dr. Charles Freed, a neurosurgeon, who verified clinically the probability of an intrasellar tumor and recommended exploration.

Discussion. Dr. Freed discussed the case and gave a résumé of the clinical signs and symptoms of the various types of lesions that can occur in the sellaturcica region.

Dr. George Filmer told of a young woman patient who complained of slowly progressive blurring of vision. Peripheral fields were normal, although there were small central scotomas in each eye. Spinal fluid was normal. The case resembled early optic neuritis. She developed right homonymous diplopia and, during an ex-

ploratory craniotomy, a large cystic Rathke's pouch was found. The patient died. This cavernous atrophy of the disc very closely resembles glaucoma cupping, even to the overhanging veins.

Dr. T. Van Bergen asked if normal eyes gain in pressure after much water is imbibed in a short time. Dr. W. H. Crisp asked if local sclerosis could cause these changes. Dr. Freed added that any visual loss is an indication for surgery in these cases because this loss is irreparable; otherwise, X-ray therapy might be attempted. These explorations are not dangerous and should be done whenever reasonable doubt exists.

Dr. Danielson, in closing, said that changes in the normal eye probably do not occur after much water intake so that water imbibition serves as a good provocative test in glaucoma. Local sclerosis could resemble this case, but there now seemed no doubt that this was a case of cavernous atrophy.

DIABETIC CATARACT

DR. RALPH JORGENSEN presented L.H., a boy, aged 18 years, who complained of sudden loss of vision over a period of three days about three months before. A general practitioner found him to be diabetic, and he was sent to Colorado General Hospital. Examination revealed bilateral, advanced, subcapsular cataracts with no fundus details visible. Blood-sugar level was 260 mg. percent, and urine sugar showed a 4+.

DISINSERTION OF RETINA

DR. RALPH JORGENSEN presented D.R., a 38-year-old man, who had noted that vision of his left eye was suddenly becoming poor about three months before. This decrease in vision had continued. There was no history of trauma. He was recently sent to Colorado General Hospital where examination revealed the

retina to be disinserted over the lower half at the ora serrata extending from the 4- to 7-o'clock positions. No tear was seen. Field studies showed absence of the superior half of the field except for a circle of about 10 degrees around the fixation area. Vision now is: R.E., 20/15; L.E., 20/70.

Morris Kaplan,
Secretary.

NEW YORK SOCIETY
FOR CLINICAL
OPHTHALMOLOGY

December 2, 1946

DR. BENJAMIN FRIEDMAN, *president*

TECHNIQUE AND COMPLICATIONS OF
KERATOPLASTY

DR. R. TOWNLEY PATON presented (with motion pictures) this subject. He stated that corneal transplantation, although not difficult for the experienced surgeon, should first be practiced on animal eyes. Over the years, experience has shown that the judgment needed in the selection of cases is learned only by those who have done many of these operations. Ideal cases for operation are relatively rare, and it is for this reason that it is best to have one eye surgeon do a lot of these cases rather than have many surgeons who perform only one or two keratoplasties a year.

The visual results in certain selected cases for operation are often dramatic. Postoperative complications increase in direct proportion to the size of the graft. Grafts of at least 6 mm. should be used in keratoconus cases, and only those cases in which there is a central corneal opacity or in which contact lenses cannot be tolerated should be operated upon. Postoperative complications in suitable cases are few. Many cases are operated, whose prognosis is bad to begin with. Our

present knowledge has reached a point where we can select the operable cases with a fair degree of certainty.

Donor material. The eyes of newborn and premature infants are not satisfactory because the corneal tissue is more delicate and too malleable which causes more post-operative edema; also, these eyes do not keep as well.

Operative technique. Cutting the donor eye first gives the operator an opportunity to get the feel of his trephine. The trephine must be absolutely sharp.

The transplanting of corneal tissue for the treatment of scarred corneas has proved successful in many carefully selected cases. The operation itself is not of recent origin. Many cases were operated upon before 1900, but successful results have only been reported in recent times. Types of cases favorable for operation include those in which the scarring is central and not too dense and those in which no increased intraocular pressure is present. The presence of a large number of blood vessels in the cornea may often spoil the result of the operation. There must not be any active corneal disease present or any disease of the surrounding tissues. Uveitis of recent occurrence may be an exception.

Cases in which the scarring is limited to a small central area of the cornea, not over 5 mm. in width, and the scarred area is surrounded by healthy corneal tissue, entirely free of vessels, and the eye is otherwise considered to be normal give the best, and often the most startling, visual improvements. Visual improvement from 20/200 to 20/20 or better may be expected.

Keratoconus has not, in Dr. Paton's experience, given the best visual results for several reasons. He wished to report on only those cases in which the vision cannot be improved by means of glasses or contact lenses beyond 20/200. Because of

the dangers of using larger transplants, the operation is difficult.

NEW TYPE ORBITAL IMPLANT

DR. NORMAN L. CUTLER presented this subject with motion pictures. He stated that this implant for use in enucleations is composed of a plastic sphere with a gold ring for muscle attachment and a gold face plate into which fits a metal pin on the prosthesis. This gives a positive mechanical contact between the prosthesis and the implant.

An average movement of the prosthesis of 70 degrees, horizontally, and 65 degrees, vertically, is obtained. In addition, there is instantaneous movement over the shorter ranges. Some patients who can converge preoperatively are also able to converge postoperatively. The film showed postoperative results of this type of implant.

Discussion. Dr. Byron Smith said that past experience, with heterogeneous tissue transplantation and integumentary tolerance to foreign bodies justifiably causes us to accept with skepticism any advance in this field. In retrospect, it is difficult to understand why we have been so retarded in a more logical approach to the proper camouflage of ocular prostheses.

Nonirritating foreign bodies, completely submerged in tissues, are relatively well accepted by the human organism. Partially submerged foreign material as described by Drs. Ruedemann, Cutler, and Hughes, defies the laws of nature and has a tendency to nullify our previous concepts of surgical principles. The discouraging cosmetic results and complaints of the patients suffering from the presence of the early Ruedemann implant are not uncommon to some of us. The complex secondary surgery required in the removal of such an implant is, unfortunately, familiar to few ophthalmic surgeons.

At a meeting of the American Ophthalmological Society, in 1945, Dr. Wendell Hughes presented the details of a partially submerged vitallium integrated implant. He suggested that an oval, rather than a spherical, contour is an advantage in preventing rotation of the implant. Rounded rather than square corners at the contact between the implant and artificial eye was described as an asset in maintaining hygienic conditions in the orbit containing the prosthesis.

Erosion of glass by the fluids of the eye socket is frequently encountered. Individual allergy to plastics and plastic eyes is a recognized affliction. It is assumed that erosion and allergy of partially imbedded vitallium is less than might be expected from plastic.

Since I am not acquainted with Dr. Cutler's surgical resident, but have had an opportunity to observe Dr. Hughes, it is probably unfair for me to remark that implantation of the device into the muscle cone and Tenon's capsule is a major surgical undertaking. The modified Mules implant of vitallium described by Dr. Hughes for insertion through the sclera beneath the superior rectus muscle by the Burch technique of evisceration is technically simple and immediately effective. The narrow peripheral, perforated disc of remaining cornea securely surrounds the zenith of the implant, heals rapidly, and has been the source of no sensitivity.

In closing, I would like to ask Dr. Cutler a few questions:

1. What is the duration of time required for you to execute the implantation of the prosthesis you have initiated?

2. Have you encountered local tissue allergy to the implant in any of the cases you have treated?

3. Have you observed any postoperative deviation or rotations of the implant on its anterior-posterior, vertical or horizontal axis?

Dr. E. Waldstein asked whether it is necessary to use general anesthesia.

Dr. Barnard asked if the implants could be removed by the patient, and if so how frequently, and how difficult it would be to replace them.

Dr. Bernard Kronenberg asked whether it would be worth while to use the oblique muscle in this procedure.

Dr. B. Friedman asked if it were possible to reoperate old cases.

Dr. Cutler, in closing, replied that there are other techniques which are being used that are of interest. He remarked that since there is so much interest being shown at present in the use of implants, some day something adequate will be discovered for a heretofore inadequate procedure. He expressed the hope that there would be sufficient improvement to standardize the procedure in enucleation. The limitation of space in which a prosthesis has to move makes perfection impossible.

Dr. Cutler's procedure takes about one hour. It is rather tedious, but does not require anything unusual in experience and skill. The fact that these operations were done by eight different men in the first two dozen cases, indicates that it is quite routine. In regard to local allergies, he stated that he had not seen any local reaction from plastics. Some of the patients were observed for six months and none of them developed any tropia. Some of his patients have been seen by other ophthalmologists and no cases of tropia have been reported.

As regards doing the operation under general anesthesia, Dr. Cutler said that it could be done, but that he is inclined to use sodium pentothal on most middle-aged patients.

As for removing the eye and cleaning it, contact-lens suction discs have been used. The length of time it can be kept in the socket varies a great deal. Some individuals can leave it in for 1 or 2 months without removing it.

In regard to the oblique muscles, nothing has been done, since that would add quite a bit to the operative procedure. As for reoperating for removal of glass balls, one of these operations had been done and it is planned to take preoperative and post-operative motion pictures of some others. In these cases all that is done is to make a cruciate incision through the conjunctiva and roll Tenon's capsule around the ring and suture it into place. There is no particular advantage in isolating muscles. In this case the technique worked without difficulty.

TRAP-DOOR OPERATION FOR GLAUCOMA

DR. LOUIS A. LEHRFELD spoke of Lieut. Col. H. Herbert of the Indian Medical Service, who had contributed many splendid articles on the surgical treatment of glaucoma from 1903 to 1934. Dr. Lehrfeld described (with motion pictures) the well-known "trap door" or flap operation, which had been devised by Dr. Herbert initially for absolute glaucoma but which was later used for all forms of primary glaucoma.

Using a narrow Graefe knife, an incision is made in the sclera, 2 mm. long and 1.5 mm. from the corneal margin in the lower outer quadrant of the globe. From the two ends of this small incision, two shorter forward cuts are made to the limbus by turning the edge of the same narrow blade forward and sawing carefully to avoid puncture of the iris. Thus, a small rectangular flap or tongue of corneoscleral tissue is made.

A modification of the technique is presented by making the trap-door in the silent or safe area of the sclera, in the region of the pars plana ciliaris. This site is selected, because there can be no damage to the ciliary, no damage to the lens, or no damage to the iris. Heretofore, all operations for primary glaucoma were in the region of the corneoscleral junction, the danger zone of the eye, where sur-

gery in itself may so complicate the glaucoma as to prove fatal to the eye.

Dr. Lehrfeld said that no attempt is being made to substitute the Herbert operation for the well-known and accepted surgical procedures for glaucoma. The modified Herbert operation is offered as an additional, elective surgical procedure, based on the principle of securing a continuous and slowly draining aperture in the sclera away from the danger zone and in the silent area of the eyeball.

Discussion. Dr. B. Friedman asked whether, in the event that the tension is not controlled by the operation, this would lead to a staphyloma of the operated area. Would leaving such a large opening in a vulnerable spot subject the eye to rupture from external pressure?

Dr. Lehrfeld, in closing, replied that in 20 cases which he had operated, no such occurrences had taken place.

Bernard Kronenberg,
Secretary.

NEW ENGLAND
OPHTHALMOLOGICAL
SOCIETY

November 19, 1946

DR. HOWARD F. HILL, *presiding*

VISUAL ACUITY TESTED WITH MOVING
OBJECTS

DR. ELEK J. LUDVIGH said that, in view of the absence of any information on this subject, it was deemed advisable to conduct an investigation of this subject, particularly since the eyes are so often and critically employed under these conditions.

The first and simplest type of motion to be investigated was that of simple rotary motion of the test object. This was obtained by viewing variable sized Snellen test letters through a prism of various strengths rotated so that letters appeared

to travel about in a circle in a plane perpendicular to the line of sight, monocular observation being used. Visual acuity was reduced by increasing the angular velocity and by the speed of the moving test object. The conclusion was that when an eye follows an object moving about in a circle in a plane perpendicular to the line of sight, the acuity will be reduced either by reason of the eye being unable to move sufficiently rapidly or by reason of the inability of the individual to change the innervation to the various eye muscles sufficiently rapidly, or both.

When the visual acuity was tested with the eye following an object moving in the horizontal dimension, an angular velocity of 170 per second was required to reduce the vision to 20/200, whereas when the test object was rotated, an angular velocity of only 62 per second was required. This was to be expected since experiments with the rotating test object showed that inability to change innervation rapidly was a factor and that conjugate lateral movement is apparently a relatively simple movement to innervate.

Dr. Ludvigh then outlined further proposed lines of investigation with the test object moving in various ways and conversely with the test object being stationary and nystagmus being present. In the latter situation initial experiments had been started by making short exposures of letters to see if the visual acuity was increased or decreased in a case of nystagmus, but conclusions could not be drawn. He said that he would welcome any further suggestions on this problem.

In the discussion that followed, the use of the stroboscope in the study of nystagmus was suggested, but Dr. Ludvigh thought that the swing of the nystagmus was not sufficiently regular to employ it. In reply to questions in regard to head movements, Dr. Ludvigh said that they had not been permitted in the experiments as yet because it would be superimposing

another factor on the problem of eye movements. However, he thought that the fixation in following moving objects would be more accurate with head movements permitted, inasmuch as the head would take care of the grosser portions of the movements, which would necessitate the eyes following only a little.

PROBLEM OF OPHTHALMIC EDUCATION

DR. W. J. B. RIDDELL of the University of Glasgow, Scotland, gave the main paper of the evening. He said that in recent years great thought and planning have been devoted to various aspects of medical education. Certain factors have contributed towards this activity in the United States and in Britain. There has been a desire on the part of the Universities and Medical Schools to raise the standard of the undergraduate course, and this has led to a demand for more trained graduate instructors. This activity has been more marked in America where the ratio of teachers to students is very high compared to Europe. Facilities for study in other medical schools and the provision of necessary scholarships, free from routine clinical work, have increased the interest aroused in graduate training. The number of such opportunities is many times greater in America than in Britain.

The medical courses in the two countries differ in important respects. The British student graduates as a Bachelor of Medicine and Bachelor of Surgery (M.B., Ch.B.) from his University after a course lasting five or six years; a certain proportion, around 15 to 20 percent, proceed to the higher degree of Doctor of Medicine (M.D.). It is not possible to obtain the latter degree without possession of the two former ones. The graduate wishing to specialize, particularly if he aspires to a position on the staff of a teaching hospital, must also obtain a Fellowship from one of the Royal Corpora-

tions. These corporations are medieval guilds which have continued throughout the centuries in a modified form.

It is possible to obtain a Fellowship in which ophthalmology forms part of the examination in Scotland and Ireland. New regulations for the English Fellowship are projected in which ophthalmology forms the principal subject of the final examination. A primary examination on the basic series of Anatomy, Physiology, and Pathology will remain common to all candidates.

The diploma in Ophthalmic Medicine and Surgery (D.O.M.S.) is obtained by examination and is of somewhat similar scope to the certificate of the American Board of Ophthalmology. It was introduced mainly to raise the general standard of ophthalmic practice and to assist the public, insurance societies, and similar bodies in recognizing medical men qualified to carry out ophthalmic examinations.

One of the dangers attending the elaboration of highly trained specialists is that there tends to be an excess of experts in certain chosen centers who are unwilling to leave the academic or scientific atmosphere in which they have been reared. In so far as this happens it is a reflection upon the teachers; they have failed to produce an all round craftsman capable of performing his chosen job of work apart from elaborate equipment and buildings. There is no doubt that a great loneliness descends upon the young surgeon during the years immediately following his period of residence and research in a big center. This lasts until he finds his feet in a new area, but the isolation may be relieved by the stimulating effect of small visiting surgical clubs and associations. Organizations of this type were dear to the heart of Osler, whom it will be recalled started at one time to become an ophthalmic surgeon. Our loss has been the great gain of general medicine, and

we may speculate upon what he would have contributed to ophthalmology had he devoted his genius to it.

There are certain developments in ophthalmic teaching which can be regarded with some misgiving. Many students have to spend time on acquiring an examination knowledge of subjects in which they have no real interest and no practical acquaintance. Some planners seem unable to appreciate a vital educational principle which was expressed so clearly by Sir Richard Livingstone, Master of New College, Oxford, a few years ago. "The principle is that almost any subject is studied with much more interest and intelligence by those who know something of its subject matter than by those who do not; and, conversely, that it is not profitable to study theory without some practical experience of the facts to which it relates."

Dr. Riddell has great hope and confidence that ophthalmology will continue to develop powerfully in both England and America. In Britain they envy our libraries, clinics, and research facilities; they are proud of their own clinical traditions and are conscious of their scientific failings. In no special branch of medicine is a sense of historical perspective so well developed as in ophthalmology. The great British clinical school of the 19th century was followed by the dominant position gained by Germany at the beginning of the century. Britain now turns towards the New World for inspiration and finds it in full measure.

Discussion. DR. EDWIN DUNPHY said that an English friend once said to him (and Dr. Riddell touched upon it tonight): "The greatest bar to misunderstanding between our two countries is our common tongue."

In continuing, Dr. Dunphy said that because of the fact that we speak the same language, many of us on either side of the Atlantic might feel that we should

have the same customs. As a matter of fact, they differ tremendously in many respects. I am sure that Professor Riddell has been just as mystified by many of our medical customs as I was with the British system when I lived there in 1943 and 1944.

Professor Riddell has outlined some of the similarities and differences as they appear to him. As an American living in the British Isles, one of the things that impressed me most was the absence of the State Board examinations.

Another notable difference that impressed me was the extremely young age at which the British medical men can begin to practice. There are no age requirements for matriculation in the medical school, a man will often enter at the age of 17 or 18 years, and will graduate at the age of 22 or 23 years. Practically 15 or 20 percent of these men have an A.B. degree.

Although such a system lightens the economic burden, it would perhaps seem to us that the advantage must be weighed against a certain lack of maturity in starting to heal the sick, and also, possibly, a lack of training in the liberal arts. That might seem so, but, as a matter of fact, the difference is not as much as you would think, because I am quite sure that the average young Briton, aged 17 years, is much more matured than the American of the same age.

Coming to ophthalmology—both Britain and America are faced with the problem of not having enough ophthalmologists. I think that is true in this country more than in Britain. That is, we need ophthalmologists to take care of all the ophthalmic needs of the population.

For instance, in the United States, as you all know, 75 percent of the refractions of the general population are done by optometrists. Some may not think that is a very bad thing, and others think it is too bad. Also here in this country, we

have 7000 ophthalmologists, and we need, as was said, about 300 new ones a year to make up for the loss in death and retirements. We were training, as of December, 1941, 180 new men and women a year, and now we are qualifying about 250 a year. Therefore, we have a deficiency in the residency training of ophthalmologists. Certain other candidates are being trained by means of short courses and apprenticeships, and are being certified by the American Board of Ophthalmology, if they pass the necessary examinations. The American Board has not reduced the standards of the examinations, and, as far as I know, does not intend to.

In order to meet this shortage problem, we can either develop more residencies to train more men to become top-flight surgical ophthalmologists, or else we can train more medical ophthalmologists by means of postgraduate courses. If we adopt the former plan, and if it were possible to double or triple our residencies, we would have to cut down on the amounts of surgery and on the individual instruction of surgery, and there would not be enough to go around. On the other hand, if we greatly expand our postgraduate system courses to take in hundreds and hundreds of new men, we may be able to develop enough medical ophthalmologists to become good sound diagnosticians who can compete with the optometrists in serving the refraction needs of the country, leaving the residency training to the men who do the surgery.

In an editorial, I read some comments upon the difference between the American and British outlook in this teaching program: "The aim of the American side of the Atlantic is a very thorough and complete training of a relatively few high-grade specialists. On the British side, the aim and basic conviction of a large number is for a shorter time, leaving it to the

initiative of the few to obtain for themselves the final gloss and polish of academic distinction."

The American Board of Ophthalmology stated that short courses are an abomination, unsound pedagogically, and productive of a poor grade of practitioners. Nevertheless, Lancaster feels that we should be realistic about the situation, and face the fact that there never will be enough residencies to take care of the demand. Therefore, he feels that perhaps it is better to give short basic courses to all who apply, trusting that enough good men will be given their chance to make good and go ahead to make up for the undoubtedly great number of poor men that will be taken in. He feels that these basic subjects can be taught by lectures, quizzes, and reading, and thus large groups can be instructed at one time. Those who cannot obtain residencies should be placed as apprentices in older doctors' offices. How such a scheme will work remains to be seen. I think it is too soon to judge it.

Here at Harvard Medical School, we feel that laboratory work is essential to the teaching of basic sciences. This type of teaching can best be done with relatively small groups and by full-time research men rather than clinicians. This basic training should be followed by clinical residencies, with a form of instruction continued by clinical men. This is the policy that we are maintaining. I admit that it doesn't solve the main problem in the slightest. Perhaps the solution may lie in the development of ophthalmic technicians such as has been suggested by Parker Heath, who is with us tonight. Such a group could be developed in the colleges—not right away, of course, but on a long time program—giving about two years of training in physics, chemistry, biology, physiology, mathematics, and optics. This two-year training period would be followed by perhaps a one year

training in the hospitals, in refractions, and so forth. Such a person could then be employed by the ophthalmologist and work entirely under his supervision. Perhaps such an ophthalmologist could employ two, three, or four, and the load would be correspondingly reduced.

I don't know the answer to the problem. I do not for a moment doubt the sincerity of purpose of those who believe in training large numbers and in so-called medical ophthalmologist short courses. Personally, I mistrust the wisdom of such a course. A number of men so trained by this course will undoubtedly develop into very excellent ophthalmologists, I know, but I fear that we may flood the country with some very mediocre material.

DR. PARKER HEATH said that he was very much interested in the various angles which had been discussed. Since ophthalmic technique was a little hobby of his, he was glad to say something about it.

The point is that optometry itself is a dying profession. There were relatively few going into optometry before the war, and the present increase in optometry is apparently a by-product of the educational impulse which is going around the country.

Ophthalmology has not met the needs and qualifications, so far as the demands are concerned in the medical field. We have had this tried and true method of training people whereby every doctor had a nurse or someone else trained to help him with the onerous part of the practice. The extent to which these assistants can go is dependent on the ability to teach of the man in the office. That is, the assistant can do refractions, assist on smears and cultures, assist in the office and have a real, not quasi, professional relationship which can be described as an ophthalmic associationship. The basic principle involved is the distribution of medical care. The public isn't accurate in its classification of teachers and practitioners. Only

by roundabout methods do they find out where to go and what to do about their optic difficulties. So, the boards are established to help in this matter—State boards, ophthalmic boards, and so on.

The problem is one of medical care and medical distribution of this care. Any thing we can do to help shift the care and cover a wider field is going to help solve the problem.

I put forth this idea, which isn't necessarily mine (it might be an old idea in a new dress) of the ophthalmic associate—one who serves under medical aegis all the way through, who is bound by the same medical standards maintained under the same medical code, not answerable to a board outside but under medical ethics to the American Board of Ophthalmology.

We seem to be living a one standard or preaching a one standard practice, but at the same time to be living a two standard existence, because there are medical ophthalmologists and surgical ophthalmologists, and the greatest need is for medical ophthalmologists. I would say why not have two kinds of diplomas? This would be one solution, so these people who are medical ophthalmologists can have their place in the sun and be a recognized group. They prefer their work to that of the surgical ophthalmologists.

The second suggestion is to furnish a group of ophthalmic associates who can be educated in colleges as far as humanities are concerned. Technical training can be given by medical men themselves.

DR. S. JUDD BEACH said that the first thing that he had to say was in regard to the course that Dr. Lancaster has supervised and organized. If Dr. Lancaster were here to speak for himself, Dr. Beach felt sure that he would agree entirely with Dr. Dunphy that the thing to aim for is the type of course given at Harvard rather than the short courses which have been arranged to fill in during the in-

terval when nothing else is available. A course is obviously better when it is conducted along didactic lines, followed by a proper laboratory and clinical program. The type of course that Lancaster has arranged cannot fairly be called a short course, in the sense that the refresher courses, for instance, are short. There are short courses at the George Washington University and in Rochester, but they are entirely different.

Concerning the men who have come up to the Board for examinations the records of those taking the study council courses have been, I won't say all that is to be desired by any means, but very much better than those of the men who have taken a refresher course, feeling that it would fit them for a Board examination.

Dr. Beach expressed to Dr. Riddell the indebtedness of the Board for making the suggestions which led to the formation of the Board. These suggestions came through Dr. Jackson and were based on the type of examinations which were given in Britain. In the second place, Dr. Lancaster's course was copied in some part from the courses given at Oxford, which Dr. Riddell has mentioned tonight and which he had a part in organizing.

In the third place, Dr. Beach thought that the very important suggestion which Dr. Riddell had made ought to be considered, and that was that medical ophthalmology should be perhaps more thoroughly worked out in the examinations by, as he said, neurologists and the like for examiners. Actually we should have a second surgical certificate from the Board, to be given to those men who can do surgery. Dr. Beach said that the young men who come into our office tell him that they find it very much more difficult to perform good refractions than operations. He is not at all sure but that the second and advanced certificate should

be given in medical ophthalmology.

DR. RIDDELL (in closing): You have mentioned how easy it is for a medical man to practice in Britain, that he needs only register to protect the public. That is nothing—any layman can operate with a razor blade if he wishes to. If the patient dies, that is too bad. If he is a registered medico, he's O. K. Similarly, a quack cannot sue for fees. Apart from that, it is a free country.

You also mentioned that students start earlier. The average age is 18.3 years. As for myself, I skipped off to the Navy. They start in the University with biology and physics.

In regard to refractions—it is the same in Britain as in America, 75 percent are done by the optometrists and opticians.

A great deal of the training is done by apprenticeships and bedside teaching. That's one of the reasons why the universities in Britain are opposed to technical training—they are not keen on building up technical training in the universities. For some reason, there are no professors, or hardly any specialized professors in the universities. That's just the way we do things.

This business of ophthalmic technique is a very difficult one. We will probably do something similar to what Dr. Heath outlined for you tonight. I wouldn't be surprised if we were to have supervised ophthalmic technicians for Scotland.

Medical ophthalmology is an enormous thing in itself. It can be very fascinating. There have been surgeons who have abandoned the surgical in order to devote all their time to ophthalmology. There is a larger question of proportion in these things that has to be considered. That is how I think about it—we must have technical assistants (call them optometrists) in an equal proportion or balance for the particular community or state which has to be served.

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OPTOMETRY AND OPTICAL DEVELOPMENTS

In his testimony before the Committee on Military Affairs, House of Representatives, held in Washington on July 3, 1945, at a hearing on a bill to establish an optometry corps in the Medical Department of the United States Army, Mr. Leslie R. Burdette of Salem, Oregon, past president of the American Optometric Association, included the following remark in his statement: "Parenthetically,

I should like to add that these highly developed instruments which are so necessary for the correct diagnosis of visual defects have in most instances been invented or considerably improved by physicists and optometrists not by physicians." In refuting this claim, Dr. Alan C. Woods, professor of ophthalmology, Johns Hopkins University School of Medicine, stated: "They (the optome-

trists) have made extraordinary claims regarding the apparatus that they have designed and perfected. In answer to that claim, I can only tell you that in the Wilmer Institute, which I believe is one of the best equipped in the world, I do not know of one single, solitary piece of apparatus in the whole institution that owes its genesis to optometry."

Legalized optometry is only 39 years old, dating from 1908 when the first optometry law was passed by the State of New York. It was instigated by Charles F. Prentice so that he could legally charge a fee for his services. Like the creator of Frankenstein, the father of optometry found that his brain child developed otherwise than he would have wished, and in his memoirs decried the unwarranted assumption of the title "doctor," pseudo-scientific pretenses, aggressive commercialism, and dubious practices.

At the same time that optometry made its advent, ophthalmology had reached a high degree of development, especially in the field of physiologic optics and optical instruments. The progress through the ages had first been very slow, and to the mathematicians we owe the fundamental laws of optics—Euclid, Alhazen, Snell, Gauss, Euler, Listing, and Lambert. The astronomers—Galileo, Airy, Kepler, and Hooke—gave us the telescope and the spherocylindrical lens, clearer conceptions of the function of the human eye and vision, and the concept of the minimum separable. The learned clergy-scientists—Roger Bacon, Sheiner, Mariotte—contributed the first publication on spectacles, the demonstration of accommodation, and the knowledge of the blindspot. The physicists—Newton, Fraunhofer, Brewster, and Wheatstone—discovered the nature of color and invented the stereoscope. The physiologists and psychologists—Mueller, Weber, Koenig, von Kries and Weber—clarified the facts of visual sensation and

adaptation, giving interpretive significance to the data of anatomy, histology, and biochemistry. Much of this, and particularly the pioneer works of Young and Helmholtz, paved the way for the monumental work of Donders that appeared in 1864 and at last placed refraction of the eye on a scientific basis. On this firm foundation, numerous ophthalmologists have contributed to the superstructure—notably Tscherning, Nagel, and Duane. The problems of orthoptics and ocular motility, first emphasized by Javal, numbered among its eminent devotees Stevens, Savage, Howe, and Maddox.

Meanwhile the optical armamentarium rapidly increased. In 1784, Benjamin Franklin invented bifocals; in 1804, Wollaston designed the meniscus lens; in 1839, photography was simultaneously discovered by Daguerre and Talbot; in 1851, came Helmholtz's epochal ophthalmoscope. In 1857, Jaeger provided reading charts; and in 1862 Snellen devised the modern refraction chart. In 1867, Green introduced the improved astigmatic dial, modified by Lancaster and Verhoeff, now used. Cuignet invented the retinoscope in 1874; Javal and Schiøtz, the ophthalmometer in 1880. Of the numerous optical instruments since developed and in daily office use, none of which, parenthetically, have been devised by optometrists, probably the most essential are Jackson's cross cylinder, Gullstrand's slit-lamp and corneal microscope, and Lloyd's stereoscopic scotometer.

The optical companies with their scientific staffs in applied optics have made and are making notable contributions. Von Rohr popularized vertex refraction and punktal lenses; Clifford Brown furnished the valuable duochrome test; and worthy improvements in bifocals have been made available.

The history of the development of contact lenses is liberally coated with

the names of physicists from Sir John Herschel, 1845, to Müller, 1887, and Professor Abbe of Carl Zeiss, 1888. Fick, ophthalmologist of Zürich, in 1888, coined the term "contact lens." Dallos of Budapest made the first impressions of the eye with negocoll, followed later on by Obrig, an optician. With much fanfare, Feinbloom, an optometrist, and Beacher, an optometrist, hopped onto the band wagon. There is now a considerable commercial value in the business of fitting contact lenses.

The authors of the leading textbooks that are used in the schools of optometry—Southall, Sheard, Fincham, Emsley, Swaine—although teaching in schools of optometry are not optometrists at all, but are physicists specializing in the applied optics of refraction.

The writings by the practicing optometrists in the various journals of optometry are quite another story. Here we see glasses with invisible tint, cures for color blindness, the improvement of vision without glasses à la Bates, muscle and prism exercises for the cure of myopia, revolving colored lights for the cure of many ocular diseases, unknown and unnamed, expensive nonsense for remedial reading, and visual training couched in gobbledegook language. All of these practices betray an ignorance or disdain of the fundamentals of physiologic optics, anatomy, physiology, and pathology of the human eye. Could it be possible that Mr. Burdette, O.D., was referring to these items in his remarks about "highly developed instruments?" If so, then the ophthalmologist will gracefully concede him the honors.

Derrick Vail.

OPHTHALMIC DISPENSING

Perhaps "optical dispensing" would be a rather more logical term; but there may

be a certain utility in recognizing that the great State of New York has adopted the caption title in its dealings with the subject. The implications of either term are sufficiently broad to touch the whole optical trade, even indirectly the wholesale manufacturer of lenses, although more particularly the frame maker and dealer, the retail optician, some jewelers, the refracting optician or optometrist, and the prescription optician. Many physicians who dispense their own prescriptions would come within the heading, although exempt from special laws dealing with this practice.

The ophthalmologist who relies upon the work of retail opticians rather than upon his own personal activities in optical dispensing learns to have considerable confidence in the judgment and, as suggested by Post in his editorial in the June issue of this JOURNAL, even the advice of such opticians as to technical details concerning frames and lenses. But the ophthalmologist may also find cause to be disgusted at the inadequacy of training of other optical technicians with whose work he comes into occasional contact.

It is a source of satisfaction to know that there exists within the ranks of the optical trade an active movement toward improvement in the standards of optical dispensing. Ophthalmologists who realize the importance of the subject may profitably study the April-May issue of *Guildcraft*, the organ of the Guild of Prescription Opticians of America (1947, volume 20, number 6).

Among other items, that issue contains the following material. First, the New York State Department of Education announces its initial Examination in Ophthalmic Dispensing, held May 8 and 9, 1947, under the special provisions of the Education Law adopted by the State of New York in 1946. This law requires that ophthalmic dispensers practicing as

such on July 1, 1947, must hold certificates in that capacity issued by the Department of Education, unless duly licensed to practice medicine or optometry in the State. Subject to certain exceptions as to those already engaged in such practice, candidates must have completed a year of study in a "school of ophthalmic dispensing registered by the Department as maintaining a satisfactory standard," or must have had at least one year of acceptable training and experience in ophthalmic dispensing under the supervision of an ophthalmic dispenser, physician, or optometrist.

The next item in the quoted issue of *Guildcraft* describes a technical course offered by the Institute of Applied Arts and Sciences of the New York State Department of Education, including periods in mathematics and physics; in "ophthalmic materials" (including the history of spectacles, development of ophthalmic lenses, the manufacture of lenses, and various details with regard to glass, grinding and polishing materials, metals, alloys, and plastics used in the optical trade); in prescription laboratory technique; in lens surfacing; and in the verification and inspection of spectacle products. Further, the student is instructed in the principles of refraction and the phenomenon and theory of vision and the physics of light; including the principles involved in various well-known ophthalmic instruments. Finally, he is given a definition and outline of "services rendered by each group in the eye-care field."

The fourth item in the April-May issue of *Guildcraft* is the noteworthy address by Benedict, mentioned in Post's excellent editorial in the June, 1947, issue of the *American Journal of Ophthalmology* (page 765). It will have been observed from that editorial that the Junior College of Rochester, Minnesota, on the in-

itiative of the Ophthalmological Division of the Mayo Clinic and of four major trade organizations, has already created a two-year course in "Opticianry" (a new term coined for this purpose), and that it is proposed to follow that course by at least a five-year apprenticeship before the candidate is permitted to apply for certification as "Master Ophthalmic Optician."

No doubt opportunity will be afforded later to compare this plan with that announced from New York, and indeed with other such educational schemes which may be expected to develop in different parts of the United States. It will be interesting to consider how such plans are likely to influence the development of shop and counter work in optics, as well as the trade and professional relations between ophthalmologists, optometrists, and the general public.

When, in 1827, the astronomer Airy calculated the strongly compound myopic astigmatic error of his own left eye, with its "major axis" at 35 degrees from the vertical, he went to an Ipswich optician named Fuller, who ground the necessary concave spherical curvature on one side and the concave cylindrical on the other.

Fuller no doubt was a man of moderate schooling but of long apprenticeship to a master optician. In those days it was the common thing for technical training to be obtained by many years of apprenticeship. The apprentice first ran errands, fetched materials, delivered finished work, cleaned out the workshop and guarded it in his master's absence, and was gradually, and in the course of time, intrusted with the execution of mechanical details, so that he became more or less thoroughly intimate with the principles and practice of the artisan to whom he had been bound by contract.

The same sort of approach to expertness was found in the studio of the sculp-

tor or painter artist or in the printing establishment. The teaching of medicine or of the "apothecary's art" long went through somewhat similar developments, and it is only something like three quarters of a century since the great majority of this country's physicians depended, at least for a large part of their training, upon the guidance of a preceptor to whom they occupied a relation somewhat similar to that of the apprentice in other crafts.

A comparable approach to the optician's craft may be found today in opticians' stores and workshops. However, there is bound to be a variation in the extent to which the modern optician concentrates either on the craft of making lenses or on the commerce of selling them to the public. More and more the non-academic approach to any field of activity is recognized as open to the criticism that it leaves gaps in the pupil's knowledge. The counter optician may have had little to do with the actual grinding of lenses. On the other hand he must himself be a craftsman of a sort in the fitting of spectacle frames and also in checking the accuracy of the shopman's work. As in most lines of mechanical activity, it is pretty certain that some individuals will know more about one aspect of the craft or trade, others more about other aspects; and that few will be equally adept or learned in all details.

In such wide variations of individual experience, training, and skill lies a sound basis for demanding standardization in the technical education of those who minister to the public's optical needs. Many of those engaged in the optical trade have scattered their energies over too wide a field of related but more or less distinct responsibilities. They attempt to be at the same time diagnosticians, mechanics, and salesmen. It is well to remember that the Guild of Prescription Opticians itself represents a healthy tend-

ency toward concentration on the dispensing of optical goods.

To what extent will the general public gain by the movement now fostered, in somewhat different shape, on the one hand by the New York Board of Education and on the other hand by the Mayo Clinic in coördination with a group of optical organizations? The type of training at first selected by those who, after passing through high school or college, decide to establish themselves in one branch or other of the optical trade, will depend partly, as now, on financial considerations, and partly on the miscellany of circumstances which make for choice of job or career among the general population. Some will start without vision or ambition for the future and will develop plans as they go along. In this feverish age, perhaps not many young tradesmen will be induced to plan for a two-year course of training which may, after a further five-year apprenticeship, lead to certification as Master Ophthalmic Optician. It may be suggested that such a certificate would have to compete with that of "Doctor of Optometry," a title which is the professional goal of many of today's optical dispensers.

Granted that a move for educational standardization in this practical line is desirable, it is likely that many such as now enter the retail optical trade in a rather casual fashion will continue to do so, and that of these at least a fair proportion will still seek to obtain a state license to practice optometry.

Whereas the New York Department of Education has decided to call the trade "Ophthalmic Dispensing" (which for practical purposes we may consider as identical with "Optical Dispensing") and another group of educators, including Dr. William L. Benedict and Charles Sheard, Ph.D., propose to call it "Opticianry," may it not be better to adhere to a single

title, and of the two titles to use that which is the more adequate and logical? The term used by the New York State Board of Education appears to cover the subject rather well (unless "Optical Dispensing" is preferred) and to be logical in form, whereas the entirely new term "Opticianry" is of somewhat dubious etymology and vague significance. The two may of course persist side by side. What's in a name?

W. H. Crisp.

BOOK REVIEWS

KERATOPLASTY AND TISSUE THERAPY. By V. P. Filatov. Moscow, State publications of medical literature, 1945. 232 pages. 233 illustrations.

This book, by the chief of the Ukrainian Experimental Institute of Ophthalmology, best known for his pioneer work in keratoplasty and for his recent development of a new method of therapy with preserved animal and plant tissues and their extracts, gathers in a monograph the formerly published data of the Institute, and adds the material accumulated during the war in the various military hospitals. When the Institute in Odessa was abandoned because of the Nazi invasion, the staff of the Institute was assigned to various military hospitals where the doctors had an opportunity to pursue their clinical studies. In 1942, the Institute was reopened in Tashkent.

The preface to the volume is as revealing as some of the technical expositions. As his catechism of faith, Filatov declares that only optimism and therapeutic activity can lead to progress. He believes that every organism holds hidden within it potentialities for recovery, if one could but release them. One must therefore never give up the exploration of therapeutic resources, and when forced to ad-

mit defeat, one must leave the patient with a hope and expectation of some new discovery, which may bring relief. "Pessimism at the bedside and in science is fruitless, and not to it belongs the future." This philosophic attitude helps to understand what otherwise, because of the skepticism incident to accurate scientific evaluation, might appear as an unrestrained flight of an unscientific imagination.

The volume actually consists of two monographs, which Filatov combines for the purpose of historical perspective, inasmuch as tissue therapy was the outgrowth of his experience with keratoplasty. The first part, dealing with keratoplasty, reviews in detail the clinical experience based on about 1,000 cases, and the experimental and research data in connection with it. Filatov introduced the use of cadaver cornea into keratoplasty, and through the study of eyes enucleated after successful transplantations, demonstrated that the transplant forms a true union with the cornea of the host, and is not merely a scaffold for the ingrowth of corneal elements from the recipient's cornea. It was also shown that the cornea is preserved best without fluids at a temperature of 3°C.; under these conditions the oxidative processes are continued in the cornea and lens; and despite autolysis the preserved cornea continues to exhibit cellular division and growth. The descriptions of the indications, the various techniques, and the instrumentation conform to the requirements of a good textbook, and 143 satisfactory photographs demonstrate the final results.

In the part dealing with tissue and tissue-extract therapy, Filatov explains in detail the hypothesis which he elaborated, with some support from known biologic and botanical phenomena, to explain the rationale of this new form of therapy which is hailed in a tone of evangelism.

The numerous reports which appeared on this subject from the Ukraine Institute during the last five years had many of us wondering about the pharmacodynamics of what seemed to be advocated as a universal panacea. The fact that there were no reports on this subject from other Russian ophthalmological institutions, makes it probable that Filatov also met the normal scientific skepticism in Russia. This book is a detailed exposition of the motivation, the underlying hypothesis, the experimental data, the clinical studies, and the technique on the subject.

Preserved tissue and tissue-extract therapy is a nonspecific form of therapy, the therapeutic agent being designated as biogenic stimulators, or resistance substances, the existence of which is assumed, and the chemical nature of which is still in the process of investigation, the probability being that they are amines. They develop as a result of biochemical reconstruction in all living tissues and plants in response to an unfavorable environment, which harasses life but does not extinguish it entirely. They in turn stimulate biologic processes, and it is believed that such a phenomenon takes part in the process of evolution. Animal or plant tissues isolated from their organism, and subjected to an unfavorable, but not mortal, environment also undergo biochemical changes, resulting in the production of these substances. Tissues rich in these substances, introduced into another organism, become stimulants of the physiologic functions of the host.

In disease, pathogenic products inhibit the production of substances necessary for regenerative processes; and, on the other hand, the same pathologic process after reaching a certain intensity and duration initiates the development of biogenic stimulants; the crisis of acute infectious diseases is interpreted as the indication of a spurt in their appearance. The introduc-

tion into a sick organism of tissues rich in biogenic stimulants augments its cellular metabolism, and counteracts the inhibiting effect of pathogenic products on the formation of substances necessary for recovery. The unfavorable environment giving impetus to the formation of biogenic stimulators comprises variations in temperature and light, and various chemical agents. This in substance is the theory on which this form of therapy is based. Filatov believes that this type of therapy is in its inception, and that there are many problems yet to be cleared up.

How can maximum action of these substances be obtained? How can they be isolated? There are problems of sterility and stability; there is the possibility of specific stimulants. This, he says, is too big a task for a single investigator and he seeks to interest other workers. The techniques for the preparation of the various preserved homologous, heterogeneous, and plant tissues and extracts, and their therapeutic application are described in detail, in the hope that this information will lead to their wider use. Filatov foresees that the hypothesis may not stand the test of future investigations, and may be substituted by another theory based on a more factual foundation. Extensive clinical research may limit the sphere of usefulness of this form of therapy. But, whatever the explanation, he believes that the therapeutic effect of preserved tissue has been demonstrated and will remain incontrovertible.

The clinical material subjected to this type of therapy consists chiefly of hopeless cases, discharged as such from other ophthalmologic institutions. It is not difficult to understand that in such cases even very slight improvement may lead to an exaggerated enthusiasm. During the war the effectiveness of this therapy appears to have been confirmed in the various military hospitals, principally in Mid Asia,

where Filatov and his students worked. Regardless of the fate which the future holds for this form of therapy, the patience and the deep human sympathy motivating the sustained and prolonged efforts to restore to practically blind people a semblance of vision, adequate perhaps only to enable them to get about unaided, command our respect. The language barrier will make Filatov's book inaccessible to most ophthalmologists, and it is hoped that this review will at least define the pattern of his work.

Ray K. Daily.

RESEARCHES ON NORMAL AND DEFECTIVE COLOUR VISION.

By W. D. Wright, A.R.C.S., D.Sc., with a foreword by L. C. Martin, D.Sc., A.R.C.S., D.I.C., St. Louis, C. V. Mosby Co., 1947. Clothbound, 383 pages, 233 illustrations. Price, \$10.00.

This volume is the last word on experimentation and theory of color vision. It is the result of some 20 years of research. L. C. Martin, professor of Technical Optics in the Imperial College of Science and Technology, London, states, in the foreword, that the fundamental problems of color vision are still unsolved. The author writes: "This book should be regarded first and foremost as a record of experimental data, with theoretical discussion and speculation occupying a very secondary position." He goes on to express his personal belief that the three-response theory along lines proposed by Young and Helmholtz is probably correct. He does not, however, wish to ally himself too strongly with any theory as he believes that much work remains to be done. His opinion is that many exact experiments, the suggestions for which have already been made, should be performed as an aid toward establishing incontrovertible theory.

The first 40 pages are devoted to the

anatomy of the visual organ and the physiology of visual perception. Each succeeding chapter is introduced by a paragraph or two outlining the work contained in that chapter and in some cases descriptions of instruments that were used in the experimental work.

Most attention is devoted to the trichromatic system which is discussed exhaustively. If the mathematical details are passed over briefly by the average reader, much of practical interest to him will be found. Obviously the mathematics and other details are vital to the deeply interested student of color vision and to such a person the book is invaluable. It also will serve as a good reference book of the most recent researches in this field.

Lawrence T. Post

CORRESPONDENCE

Editor,

American Journal of Ophthalmology:

In the April, 1947, issue of the JOURNAL (page 491), Dr. S. Rodman Irvine reported on the January meeting of the Research Study Club of Los Angeles. In his report on my presentation of the subject of retinal detachment, he stated that I felt that about 10 percent of the detachments have a hole in the macula area that needs treating. This is a serious misunderstanding which, I feel, should be cleared up. I feel that probably one percent, or at most two percent, of detachments have a hole in the macula. I feel that many operations for a hole in the macula have been done when there was no hole present. I would appreciate it very much if this statement could be published to correct the impression created by Dr. Irvine's excellent résumé of the Los Angeles meeting.

(Signed) Dohrmann K. Fischel,
San Francisco, California.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
| 6. Cornea and sclera | 15. Tumors |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

RETINA AND VITREOUS

Cristini, G. Retinal spongioblastoma. *Rassegna Ital. d'Ottal.*, July 1943-Dec. 1945, v. 12-14, pp. 450-467.

The author reviews the various phases of the development of our knowledge of the pathology of retinal tumors from the time of Virchow in 1869. The different classifications proposed by numerous investigators are presented. He describes a retinoblastoma observed in a 28-months-old child, which extended outside the globe, along the optic nerve and the vorticosae veins. Histologically there were two distinct areas, one portion showing spongioblasts which were highly anaplastic, and the other astroblastic. It would appear, therefore, that neoplasms may arise in the retina which are analogous to those which develop in the encephalon. (10 figures.)

Eugene M. Blake.

Cutler, N. L. Vitreous transplantation. *Trans. Amer. Acad. Ophth.*, 1947, March-April, pp. 253-259.

The vitreous contains about 99 per cent water yet has a viscosity 20 to 200 times higher than water. It is a solgel in an unstable state, subject to syneresis under various conditions.

The results of 13 vitreous transplants, of which eight were done for vitreous hemorrhage and five for retinal detachment, are summarized. Of the former four were considered successful and one partially successful; of the latter, one was successful. In eyes with hemorrhage, the vision improved from light perception to 20/50 and from 20/200 to 20/25. All the operated patients previously had normal light perception and tension.

Following sodium pentothal anesthesia and scleral exposure, a 2-mm. incision is made through the sclera with a Graefe knife. Mattress scleral sutures are then placed and 1.5 cc. of vitreous is withdrawn with a syringe and 18 gauge needle. The barrel is disconnected but the needle is left in place. A syringe barrel containing 2 cc. of clear vitreous from a freshly enucleated eye is attached to the original needle and

injected into the vitreous. The sutures are tied, atropine instilled, and a binocular dressing is applied.

Chas. A. Bahn.

Friedenwald, J. S. Disease processes versus disease picture in interpretation of retinal vascular lesions. *Arch. of Ophth.*, 1947, v. 37, April, pp. 403-427.

This article constitutes the Sanford R. Gifford Memorial Lecture of February 18, 1946. The four major, potentially independent, processes of vascular disease include senescence, atherosclerosis, the hypertensive arteriolosclerotic process and diabetic vascular disease. These processes are discussed in detail with special reference to the pathological changes involved. The comprehensiveness of this important article makes it unsuitable for condensation. John C. Long.

Fritz, M. H. The substitution of cerebrospinal fluid for vitreous clouded with opacities. *Amer. Jour. Ophth.*, 1947, v. 30, August, pp. 979-984. (12 references.)

Gördüren, Süreyya. A Grönblad-Strandberg syndrome. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 228-232.

The author discusses the literature and presents an interesting case of Grönblad-Strandberg syndrome, with the two components of the disease, angioid streaks and pseudo-xanthoma elasticum, clearly demonstrated. Angioid streaks, which are due to the widespread degeneration of elastic tissue, were present in both eyes. A large, yellow, raised mass was present in the posterior pole of one eye. The skin of the neck and abdomen had a parchment-like appearance with raised yellow streaks. Microscopic examination of the skin in biopsy showed degenera-

tion of the elastic elements. (7 illustrations.)

D. H. Ellis.

Guyton, J. S., and Reese, A. B. The use of X-ray therapy for retinal diseases characterized by new-formed blood vessels. *Trans. Amer. Acad. Ophth.*, 1947, May-June, pp. 525-546.

In 14 patients 22 eyes were treated during 18 months with intensive X-ray therapy for vascular diseases of the posterior part of the eyeball. The doses ranged from 400 to 500 r three times weekly and were administered principally temporally. Eight patients had typical Eales disease, 4 had atypical Eales disease, and 2 had diabetic retinitis proliferans. Shrinking of the smaller vessels was observed two to three weeks after therapy and disappearance from ophthalmoscopic visibility occurred in 4 to 8 weeks. If the total dosage did not exceed 4,000 r the larger new-formed vessel showed partial shrinkage, but if more than 10,000 r the larger vessels disappeared. Regression of fibrous tissue was marked only with 10,000 r. In typical Eales disease hemorrhagic recurrence was observed but once. X-ray therapy was of no apparent value in diabetic retinoses. The marked friability of new-formed retinal vessels facilitates proliferative processes. X-ray therapy primarily affects new-formed blood vessels in the retina and vitreous. The total dosages used were 3,500-15,000 r per eye, the optimal dosage 6,000 r.

In the discussion, Alvaro reviewed the X-ray treatment of hemorrhagic retinal disease which dates back to 1919. Opinions concerning its efficiency vary widely. The effect of X-rays upon blood vessels is discussed in detail. In retinitis proliferans, the new formed blood vessels represent an effort to re-establish blood flow in an area of im-

paired circulation. Doses as small as 50 r repeated every five days have been advised. Larger doses are advised if blood vessels have formed at the disc and entered the vitreous. Hard rays are advisable in retinal therapy.

Blood in the vitreous is frequently absorbed more readily after therapy in doses of 300-1300 r. Hemorrhages in diabetic retinopathies are best treated with small doses, though the proliferative vascular process is not appreciably affected. Retinal thrombosis and occlusion of the central vessels with hemorrhage are not altered by X-ray therapy. (22 figures, 10 in color.)

Chas. A. Bahn.

Iglesias, F. G. Etiology and treatment of recurrent vitreous hemorrhages in the young. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, Feb., pp. 139-162.

A comprehensive review of the literature is presented. Ray K. Daily.

Kinney, T. D., and Fitzgerald, P. J. Lindau-von Hippel disease with hemangioblastoma of the spinal cord and syringomyelia. *Arch. Path.*, 1947, v. 43, May, pp. 439-455.

The authors present two cases of Lindau-von Hippel disease.

Irwin E. Gaynon.

Klein, B. A. Angioid streaks. *Amer. Jour. Ophth.*, 1947, v. 30, August, pp. 955-968. (10 figures, 14 references.)

Matteucci, P. Contribution to the treatment of central retinal vein thrombosis. *Rassegna Ital. d'Ottal.*, July 1943-Dec. 1945, v. 12-14, pp. 394-404.

Three cases of retinal vein thrombosis are reported with satisfactory results from treatment with retrobulbar injections of alcohol. One cc. of 2-per-

cent novocain is first injected, and after an interval of five minutes one cc. of 70-percent alcohol is introduced. The treatment is repeated in a week if necessary. The good results are ascribed to a transitory hypotension of the globe accompanied by a dilation of orbital, retinal, and uveal vessels. A similar reaction is found in experimental animals. The treatment is recommended in painful glaucoma that is hemorrhagic, absolute, or secondary to iridocyclitis.

Eugene M. Blake.

Scuderi, Giuseppe. The effect of adrenalin, ephedrine and simpamina upon arterial retinal pressure. *Rassegna Ital. d'Ottal.*, 1947, v. 16, Jan.-Feb., pp. 3-40.

Adrenalin and ephedrine injected subcutaneously in doses of 1 mg. and 5 ctg. respectively, lower the retinal arterial pressure, especially the diastolic. This is probably due to a passive, compensatory hyperemia. Simpamina (betaphenylisopropalamina sulfate) on the contrary, in doses of 20 to 40 mg. produces a constant elevation of the pressure, whereas 10 mg. has only a negligible effect upon the diastolic pressure. The author suggests that the retinal arteries are capable of less contractility, and thus are less sensitive than other vascular regions of the body. (3 tables, 39 references.)

E. M. Blake.

Silfverskiöld, R. P. Retinal periphlebitis associated with paraplegia. *Arch. Neurol. and Phychiat.*, 1947, v. 57, March, pp. 351-357.

The author describes three cases of a remarkable syndrome. The patients, young men of about 30 years of age, first exhibited characteristic retinal periphlebitis with recurrent hemorrhages in the vitreous. After varying

intervals of time, only four to six weeks in two cases, the ocular disease was followed by subacute paraplegia, with considerable pleocytosis. During the follow-up period of one to two years the patients were observed to show improvement in varying degrees.

An investigation showed that a combination of retinal periphlebitis and neurologic disease is rare.

Theodore M. Shapira.

Stine, G. H. Detachment of the choroid and the retina. Anatomic and other considerations in the differential diagnosis. *Amer. Jour. Ophth.*, 1947, v. 30, July, pp. 897-906. (1 table, 3 figures, 22 references.)

Taylor, Charles. A Case of the Laurence-Moon-Biedl syndrome showing atypical retinitis pigmentosa associated with macular dystrophy. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 211-215.

A case report of Laurence-Moon-Biedl syndrome is presented which shows the rarely-seen combination of atypical retinitis pigmentosa and macular dystrophy. The retina showed scattered pigment, and the macula was spotted with pigment. The vision was poor. The "bone corpuscle" pigmentation was not predominant. The author points out the interesting fact that analyses of reported families of this condition revealed a large number of miscarriages and early deaths, indicating severe disturbances in the genes.

O. H. Ellis.

Weinstein, P., and Forgács, J. Circulatory studies of the fundus of the eye. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 238-242.

According to the authors, patients with spontaneous venous pulsation of the fundus blood vessels have a better

retinal circulation and show 50 percent less retinal complications than persons without pulsation. In patients with pulsation the pressure drop from the arterial to the venous circulation is greater; without pulsation the arterial pressure is established at a higher level signifying capillary obstruction. Spontaneous venous pulsation disappears with reduction of intraocular tension by massage of the globe.

O. H. Ellis.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Casari, G. F. Alveolar meningioma of the optic nerve sheath. *Rassegna Ital. d'Ottal.*, 1947, v. 16, March-April, pp. 137-148.

The tumor described appeared in a 39-year-old man. The first symptom was epiphora, soon followed by progressive exophthalmos of the left eye. The interest in the tumor arises from its rarity and from its location. It had developed in the sheath of the nerve just posterior to the optic foramen. Usually the process starts in the intra-orbital portion of the nerve. The cytologic picture of the tumor is fully described. The author discusses the development of tumors of the sheath, the nerve, and those of the sheath and the nerve. (4 figures.) Engene M. Blake.

Lian, S. B. Camp amblyopia. *Ophthalmologica*, 1947, v. 113, Jan., pp. 38-44.

During the Japanese occupation of Java (1942-1945), the author saw many cases of an eye condition which he had never seen before and which the Dutch physicians assigned to the concentration camps had named "camp amblyopia." The condition occurred in

white males who had been put into concentration camps where improper and bad food prevailed. The patients' chief complaint was inability to read. Ophthalmologic examination revealed reduced central visual acuity, central scotomas, normal eye grounds (except for small striate retinal hemorrhages in a few patients) and no gross systemic abnormalities. Toward the end of the Japanese occupation when the food situation had become worse, the author saw the same condition among free (uninterned) civilians, first in the clinics for the indigent and later in his private practice. After a review of the literature pertaining to this and similar conditions (which had occurred in China, Japan and certain parts of Africa long before the last war), Lian reports five cases of camp amblyopia in patients who showed remarkable improvement after the addition of vitamin B₁ to their otherwise unchanged diet. Although favorable results were obtained with thiamin chloride alone, the author thinks that camp amblyopia is not simply a deficiency of Vitamin B₁. None of the patients with camp amblyopia showed any signs of beri-beri which still is the outstanding vitamin-B₁ deficiency disease. On the other hand, in true beri-beri, optic nerve involvement is rare. Also, it seems significant that camp amblyopia did not occur in concentration camps in Holland and Germany where the food situation was as bad as in the Dutch East Indies. Therefore the author suggests that camp amblyopia is not entirely due to a B₁ deficiency but rather to a complex deficiency in which lack of protein and minerals is an important factor. The problem of camp amblyopia is rather complicated, and there is much further work to be done.

Peter C. Kronfeld.

12

VISUAL TRACTS AND CENTERS

Kravitz, Daniel. Arachnoiditis. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 199-210.

Arachnoiditis is an inflammation of the leptomeninges which may be localized or diffuse, even to the extent of involving the entire central nervous system. Infection, especially of the paranasal sinuses is the commonest cause. Syphilis, trauma, and otitis are other important causes. The symptoms may vary considerably depending on the location, extent and severity of the lesion. Headache is frequent. In the opticochiasmal form, sight is frequently jeopardized and the discs are rarely normal. There may be primary, secondary, or segmental atrophy of the nerve, or even extreme degrees of choked disc. At times arachnoiditis may simulate cerebral tumor so closely that the true pathologic process is not revealed until operation is performed. At times the optic nerve is severely damaged by sharing in the same inflammatory process that produced the arachnoiditis. The most satisfactory treatment of arachnoiditis is the surgical separation of arachnoidal adhesions.

Nine cases of arachnoiditis treated surgically are reported.

John C. Long.

Lyle, D. J. Diagnosis of visual losses with normal fundus. *Ohio St. M. J.*, 1947, v. 43, June, pp. 620-621.

Advanced arteriosclerosis and encephalopathies may produce visual loss without changing the normal appearance of the fundus. Affections of the retrobulbar optic nerves, chiasm, and optic tracts frequently do not produce changes in the fundus at first. The diagnosis is made by visual field studies, the reaction of the pupils, the

extraocular muscles, the trigeminal and facial nerves and other neurologic studies. Roentgenologic and other diagnostic aids should be used.

Vascular lesions most frequently are the cause of disturbance in the optic radiations. Tumors may cause visual hallucinations before they produce papilledema especially if present on the dominant side. The visual field defects from lesions in the radiations usually show sharp and congruous edges with sparing of the macular fibers.

The calcarine branch of the posterior cerebral artery is most frequently involved in lesions of the visual cortex. Vascular lesions frequently produce a large defect immediately, whereas lesions caused by expanding tumors become larger late and cause sector and indentation defects in the visual field. Visual illusions result from irritation to the psychic visual cortex chiefly from drugs, poisons, and toxins. Destruction of the para- or peri-striate areas cause a loss of visual perception, recognition, and revisualization.

H. C. Weinberg.

Monnier, M., and Jeanneret, R. L. Objective recording of the conduction process in the visual pathway by combined electroretinography and electroencephalography. *Ophthalmologica*, 1947, v. 113, Jan., pp. 1-11.

An interesting neurophysiologic study from the department of physiology of the University of Zurich is presented. Under conditions of complete sensory and mental rest, the electroencephalogram shows oscillations of a certain frequency and intensity which have been designated as alpha rhythm. Sensory stimulation characteristically inhibits or arrests the alpha rhythm (*réaction d'arrêt*, arrest reaction). This phenomenon of inhibition of a cortical

activity by a sensory stimulus promises to permit closer study of the functional status of the visual pathway. Bertrand, Delay and Guillain in their monograph on electroencephalography (Masson & Cie, Paris, 1939) mention a patient with right-sided homonymous hemianopsia and aphasia whose alpha rhythm remained undisturbed by visual stimuli if the lead (for the electroencephalogram) was taken from the left occipital region. If the lead was taken from the right occipital region, typical alpha rhythm was obtained which was typically inhibited by visual stimuli. The authors (Bertrand, Delay and Guillain) attribute the ineffectiveness of visual stimuli upon the alpha rhythm emitted by the left occipital lobe to the obviously existing interruption of the left suprageniculate pathway.

The authors of the paper under review have studied the latent period of the arrest reaction (the so-called blocking time), in the hope that it would prove to be a finer, "more differentiated" criterion of the functional status of the visual pathway than the mere fact of presence or absence of the arrest reaction. The blocking time is determined in human subjects by combining electroencephalography with electroretinography. The examinee is seated before a perimeter on the arc of which the apparatus that provides the visual stimulus is mounted. The latter consists of a standardized light source, a projection system and colored filters. The leads for the electroretinogram are taken from the conjunctival cul-de-sac and from the temporal region, those for the electroencephalogram from the occipital region and from the lobule of the ear. Cathode oscillographs are used to record the variation in potential. After the alpha rhythm has been obtained and recorded for a few seconds,

a visual stimulus is applied. It causes (1) a subjective sensation, (2) the various phases of the electroretinogram and (3) inhibition of the alpha rhythm of the electroencephalogram. The blocking time, that is the time from the inception of the light stimulus to the very beginning of the inhibition of the alpha rhythm, has been found to be 0.169 second (for a normal subject under conditions of foveal stimulation). The simultaneously taken electroretinogram permits determination of the retinal portion of the blocking time, that is the time from the onset of the visual stimulation to the moment the impulses are discharged into the optic nerve. This retinal portion or retinal time has been measured to be 0.045 second (under the conditions stated above). By deducting this retinal portion from the total blocking time the postretinal or central time is obtained (0.124 second) which corresponds to the conduction time of the impulses within the visual pathway. In a patient with tabetic optic atrophy the postretinal time was found to be considerably longer and more variable than in the normal. Combination of electroencephalography and electroretinography promises to be a valuable method for the study of normal and abnormal conduction in the visual pathway.

Peter C. Kronfeld.

Verdaguer, J., and Olivares, M. L. Parinaud's mesencephalic paralysis. *Arch. Chilenos de Oft.*, 1946, v. 2, July-Oct., pp. 226-234.

The patient, a man aged 33 years, came complaining of almost continuous occipital headache, dizziness, and uncertain gait. Examination showed incomplete paralysis of associate movements of elevation, incomplete paralysis of convergence, and Argyll Robert-

son pupil. Ventriculography had not yet been done, but the diagnostic impression was of a tumor of the quadrigeminal region. (References.)

W. H. Crisp.

13

EYEBALL AND ORBIT

Delsors, José, and Matheu Climent, J. Fracture of the optic canal. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, June, pp. 536-543.

The authors report a case of skull fracture with involvement of the optic canal. A series of good X-ray pictures is presented to show the fracture that involves the optic canal. (7 illustrations.)

J. Wesley McKinney.

English, P. B. Calcification occurring in the eye. *M. J. Australia*, 1947, May 3, pp. 549-551.

Calcification may take place in the tarsal plate in chronic trachoma and in the conjunctiva in vernal catarrh and erysipelas. In the cornea it may be primary or may be secondary to hyaline degeneration. It is common at the optic disc and ora serrata and it also occurs in the sclera between the fibrils. The author reports a case in which the sclera, lens and vitreous were the seat of calcification after a postinflammatory fibrosis. (References.)

Irwin E. Gaynon.

Givner, I., Bruger, M., and Lowenstein, O., Exophthalmos and associated ocular disturbances in hyperthyroidism. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 211-219.

In 21 of 22 patients with hyperthyroidism, pupillographic examination revealed a re-dilation block. This is believed to be hypothalamic in origin and lends the first tangible evidence to the confirmation of Marine's hypothesis

that exophthalmos is due to a stimulation of the hypothalamic centers which in turn stimulates the pituitary to produce the thyrotropic hormone, which in turn stimulates the thyroid gland, and, independently, the sympathetic centers in the midbrain, causing exophthalmos.

The administration of neostigmin bromide, a preparation of vitamin E and pyridoxine failed to reduce exophthalmos. Ergotamine tartrate temporarily and substantially reduced exophthalmos. The administration of iodine orally, and pregnancy may occasionally result in regression of exophthalmos.

If vision is impaired because of involvement of the optic nerve in patients with thyrotropic exophthalmos, complete uncapping of the optic foramen should be included in the Naffziger decompression. John C. Long.

Kennedy, R. J. Ocular hemorrhages. *Cleveland Clin. Quart.*, 1947, v. 17, July, pp. 176-180.

Subconjunctival hemorrhage may result from trauma, compression of the chest, scurvy, or purpura. Vitreous hemorrhage occurs from trauma, arteriosclerosis or retinal inflammation. Retinitis proliferans is a serious sequel of vitreous hemorrhage. Occlusion of the central retinal artery causes a sudden loss of sight with the "cherry-red spot" at the macula. Hemorrhages may be small at the disc. Occlusion of the central retinal vein may be complete with a gradual loss of vision. The veins are dilated and the retina is covered with superficial and deep hemorrhages.

Hemorrhages in the uveal tract occur in arteriosclerosis, in iritis, and in the blood diseases. Choroidal hemorrhages produce permanent visual defects.

The vascular retinopathies are characterized by hemorrhage and exudate

in addition to sclerosis, hypertension and toxemia. The striate and flame shaped hemorrhages are superficial in the retina whereas the round and irregular ones are in the deep layers of the retina. (2 figures.)

H. C. Weinberg.

Magitot, A. The implantation of dead tissues in ophthalmology. *Ann. d'Ocul.*, 1947, v. 180, March, pp. 146-149.

Dead tissues used as implants in the orbit have one advantage over live tissues; they are absorbed less rapidly. Foreign substances, if similar embryologically, are usually well tolerated by the host. If cartilage is used the perichondrium should be removed. Cartilage preserved in formalin and alcohol, makes an excellent implant because it is easily vascularized and encysted. The author prefers the head of the femur of a dog that weighs about 15 Kg. It may be preserved in alcohol or formalin or sterilized in the autoclave and preserved in a sealed glass tube. Expulsion of tissue implants is less frequent than of inert substances such as metals or plastics. Implants should be covered by the ocular muscles, Tenon's capsule, and the conjunctiva. There is a moderate edema for four or five days and the implant is firmly fixed at the end of a week. The unsightly fold in the upper lid which is not infrequent after enucleation may be remedied by a cartilage implant.

The nerves in tissue implants do not survive. Corneal transplants from horses usually remain transparent in rabbits. Transplanted glandular epithelial implants such as the ductless glands frequently remain viable and in some cases functional. In successful corneal transplants keratoblasts from the host progressively replace those in the implant. Chas. A. Bahn.

Somerville-Large, L. B. **Panophthalmitis in a premature infant treated by streptomycin.** *Brit. Jour. Ophth.*, 1947, v. 31, June, pp. 362-366.

A case of panophthalmitis in an 11-day-old, premature infant is reported. Pure-cultures of bacillus proteus were obtained from the umbilical cord and the anterior chamber. The infection proved resistant to combined sulfadiazine and penicillin. It responded to streptomycin although not in time to prevent perforation and evisceration. Negative cultures were obtained from the excised uveal tissue which demonstrated the intraocular permeation of the streptomycin. O. H. Ellis.

14

EYELIDS AND LACRIMAL APPARATUS

Alvarez y Alvarez, Abundio. **Plastic surgery of the lids.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Nov., pp. 1163-1173.

Imre's technique of plastic surgery of the lids is described. The author has obtained good results by using this method with some variation of his own, in which he uses sliding triangular flaps with curved borders and horizontal bases. (4 illustrations.)

J. Wesley McKinney.

Baclesse, F., and Ennuyer, A. **Indications for contact radiotherapy in the treatment of oculopalpebral tumors.** *Arch. d'Ophth.*, 1947, v. 7, no. 1, pp. 5-17.

The authors have treated more than 200 tumors of the external eye and lids in the past four years, of which 150 were epitheliomas of the lids, 2 were epitheliomas of the cornea, 2 were conjunctival lymphomas, and 25 were palpebral angiomas. The technic of so-called "contact radiotherapy" consists in the use of low voltage (50-60 K V),

short focus (2-5 cm.), and minimal filtration. Its purpose is to give the first few millimeters of the lesion the maximum dosage while sparing the sub-jacent tissues. The authors consider it unnecessary to shield the globe when employing this technic and they have encountered no late unfavorable effects. They feel that their results have been exceptionally good.

Phillips Thygeson.

Barraquer Burch, Manuel. **A contribution to dacryocystorhinostomy.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Nov., pp. 1150-1160.

With little change in the customary technique the author successfully performed 29 dacryocystorhinostomies. In suturing the anterior flap he only put two interrupted silk sutures through the skin, nasal mucosa, lacrimal sac and back through the skin again. The stitches are tightened over a small piece of gauze which can be very easily removed. (10 illustrations.)

J. Wesley McKinney.

Bock, R. H. **A simple modification of operations for entropion of the eyelids.** *Arch. of Ophth.*, 1947, v. 37, May, pp. 650-651.

The method described makes use of the principle of the Hotz operation, namely, to fix the margin of the lid to the upper border of the tarsus by sutures. This, however, is done without cutting the skin, but only by passing three or four double-armed sutures from the conjunctival side through the upper border of the tarsus, then along the anterior surface of the tarsus downward and finally emerging through the skin 1 to 2 mm. above the row of eyelashes. The other end of the silk suture is passed in the same way about 2 mm. away from the first one, and the two

are tied on the skin side over a glass pearl on a small gauze roll after-exerting the necessary pull to produce the desired correction. (1 figure.)

R. W. Danielson.

Carreras Durán, B. A contribution to dacryocystorhinostomy. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Nov., pp. 1132-1137.

To prevent injury to the nasal mucosa while trephining the bone in dacryocystorhinostomy, the author advises an injection (1 or 1.5 cc.) of 3-percent novocaine in oil, placed under the nasal mucosa at the site of the perforation. This will separate the membrane from the bone and prevent injury of the mucosa. He describes a simple syringe to be used for the injection. (2 illustrations.) J. Wesley McKinney.

Carrearas Durán, B. Rare disturbances after Toti's operation. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, June, pp. 553-557.

A rare complication following a dacryocystorhinostomy is reported. The patient noticed a temporary change in her voice that lasted a few days two months after the operation.

J. Wesley McKinney.

Casero, L. Inverse Bell's phenomenon. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, June, pp. 588-592.

In the normal Bell's phenomenon there is elevation and slight outward deviation of the eyeball when the lids are closed and in the inverse phenomenon the deviation of the eyeball is down and inward. A boy, 16 years old, with an inverse Bell's phenomenon is reported. The patient had suffered a traumatic wound on his right upper lid six years before examination. After this

was healed there was an ectropion of the lid with conjunctival hypertrophy and an inverse Bell's phenomenon of the right eye. The abnormality is an acquired abnormality of oculomotor synergy. J. Wesley McKinney.

Chavarria López, F. A. Large polyp of the right lacrimal sac with spontaneous healing. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Nov., pp. 1127-1131.

The polyp developed in a patient who formerly had bilateral dacryocystitis, and at the time that he presented himself for examination had an acute attack of dacryocystitis of the right side. The polyp separated itself from the sac after spontaneous healing of the process.

J. Wesley McKinney.

Cornalba, Gaetano. A case of cylindroma of the lacrymal gland. *Rassegna Ital. d'Ottal.*, 1947, v. 16, Jan.-Feb., pp. 41-49.

A 29-year-old man developed gradual exophthalmos and displacement of the left globe. The histologic picture showed the morphologic characteristics of a cylindroma of the orbit, originating in the lacrymal gland. The tumor consisted of mixed epithelial and endothelial cells with participation of fibroblastic tissue. (7 figures, 21 references.)

Eugene M. Blake.

Fox, S. A. Lipiodol studies of chronic dacryocystitis. *Amer. Jour. Ophth.*, 1947, v. 30, July, pp. 878-884. (9 figures, 10 references.)

Landau, J. A case of congenital vertical shortness of the lids combined with tetrastichiasis. *Brit. Jour. Ophth.*, 1947, v. 31, April, pp. 219-222.

The author reviews the literature, and presents an unusual case of congenital vertical shortness of the lids. The patient also had tetrastichiasis, combined with a partial eversion of the cutaneous part of the upper lid margin. It appeared that the hair follicles of the supernumerary cilia had taken the place of the Meibomian glands, and occupied their ducts. No inflammation of the eyes had occurred. O. H. Ellis.

Leriche, Rene. Surgical treatment of Sjögren's syndrome; the result, after 28 months, of bilateral section of the vertebral nerve. *La Press Medicale*, 1947, no. 7, Feb. 1, pp. 77-78.

Leriche reports the case of a woman 50 years of age who consulted him because of dry mouth and dry eyes of 12 years duration. Her general health was good except for menopause which had taken place during the course of her disease. The eyes showed complete absence of tears as measured with filter paper. Repeated sympathetic blocks with procaine each time produced a hyperemia of the facial region with lessening of the dryness of the mucous membrane. The roots of the vertical nerve on the right side were cut and a substellar segment of the cervical sympathetic chain which included the intermediate ganglion, was excised. There was immediate improvement subjectively and objectively. Five days later section of the roots of the vertebral nerve on the left side resulted in definite return of tears and subjectively the patient was much improved. The postoperative course was interesting in that the moisture in the mouth was maintained and the patient was able to shed tears for the first time in many years. The patient died 28 months later after a hemorrhagic purpura. Her hus-

band stated that at the time of his wife's death she had still not obtained a true salivation but that her mouth was always sufficiently moist.

The author considers that surgical intervention is justifiable in a condition in which ordinary therapy is useless. He believes that the atrophy of the salivary and lacrimal glands may result in part from vascular failure and that surgical therapy leads to an active hypermia of these glands. The latter would be expected to increase their function.

In discussing surgical technique he considers it unjustifiable to remove the stellate ganglion because of the subsequent interference with the function of the heart-regulating mechanism and of the vasoconstrictors of the upper arms. The stellar ablation of the second and third dorsal ganglia would have the advantage of not producing Horner's syndrome. He states that his procedure of sectioning the vertebral nerve roots on the two sides is not the ideal operation since it leads to circulatory changes that are more cerebral than facial. It might be advisable to attack the middle part of the cervical chain, from the middle ganglion to the lower pole of the superior ganglion.

In discussing the pathogenesis of Sjögren's syndrome, Leriche considers the possibility that the disease may originate in a vasomotor disturbance that leads to elective atrophy of the glands. Phillips Thygeson.

Marin Amat, M. Importance of the deep suture in dacryocystorhinostomy. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, Nov., pp. 1138-1149.

The author believes that success in dacryocystorhinostomy depends on the deep suture placed in the lacrimal sac

and nasal mucosa. He describes his own technique.

J. Wesley McKinney.

Rostkowski, L. The operations of Hotz-Anagnastakis, of Denig, and of canthoplasty as performed in the anti-trachoma teaching organization. *Arch. d'Ophth.*, 1946, v. 6, no. 4, pp. 456-459. (See Section 5; Conjunctiva.)

Selinger, Elias. Tear sac probed through canaliculus of everted upper lid. *Amer. Jour. Ophth.*, 1947, v. 30, July, pp. 910-911. (2 figures.)

Sherman, A. E. Reconstruction of the eyelid. *Trans. Amer. Acad. Ophth.*, 1947, May-June, pp. 514-524.

Three to four hundred patients with severe lid injuries were observed in nine Army General Hospitals during two years. Generally speaking, eyelid tissues should be replaced by eyelid tissues. The Wheeler technique which employs a full thickness graft carefully sutured in a previously prepared bed with excision of scar tissues is preferred. A good pressure dressing is considered important and should not be changed for five or six days. For small full-thickness losses and for vertical scars Wheeler's "halving" technique is advised. In younger patients the Hughes method of lid reconstruction is considered superior to Wheeler's sliding flap correction. If possible, avoidance of pedicle flaps from the forehead and cheek is advised. The Hughes method of total lower lid reconstruction is preferred if the tarsal part of the lid is missing. In extensive losses, the skin and subcutaneous tissue are elevated and with the conjunctiva are joined to the upper tarsus at a second operation. Bone grafts from the crest of the ilium

may be used if necessary. Eyelash grafts are best taken from the middle portion of the nasal end of the eyebrow. Total reconstruction of the upper lid is not as satisfactory as that of the lower. Three illustrative cases are presented showing the use of full-thickness grafts. Two cases illustrate the "halving" operation; two cases, the total reconstruction of the tarsal portion of the lids by the Hughes method; and three cases, the Hughes method of lid reconstruction combined with other procedures. Chas. A. Bahn.

15

TUMORS

Costi, C., and Larru, E. Treatment of ocular neoplasms by means of Chaoul's roentgenotherapy. *Arch. de la Soc. Oft. Hisp-Amer.*, 1946, v. 6, Nov., pp. 1175-1188.

The authors report in detail six cases of ocular neoplasm successfully treated by means of Chaoul's roentgenotherapy. They compare their results with those obtained in treatment of ocular neoplasms by other methods such as surgery, Xray, electrocoagulation, and radium and find that the highest percentage of success follows treatment by means of Chaoul's method. (11 illustrations.) J. Wesley McKinney.

16

INJURIES

Casanovas, José. Double perforation of the eyeball in accident work. *Arch. de la Soc. Oft. Hisp-Amer.*, 1946, v. 6, June, pp. 523-535.

Of 73,750 patients with ocular traumatism, 98 had a perforated wound with an intraocular foreign body. In 13 cases of double perforation of the

eye the foreign body was found to be within the orbit. The last 13 cases are reported in detail. (8 illustrations.)

J. Wesley McKinney.

Desvignes, P., and Boudon, C. Statistical study of 418 penetrating injuries of the globe treated at the ophthalmological clinic of the Hotel-Dieu, from 1940 to 1945. *Arch. d'Opht.*, 1947, v. 7, no. 1, pp. 28-50.

The authors note the increase in the number of penetrating wounds as compared to the 394 cases reported by Dollfus and Halbron for the same hospital for the years 1925 to 1933. They explain this increase in part as a result of war injuries and in part as a result of the closing of other hospitals during the war years. Young adults were most commonly involved and of the 399 unilateral cases 322 were in males. There were 19 bilateral injuries, all but one of which were war injuries. Cause of the injury was known in 337 cases and of these 87 were industrial accidents with penetrating metallic foreign bodies; in 26 cases the penetrating agent was wooden. There were 72 infants in the series.

Prognosis varied according to the nature of the traumatism and the site of the wound and the authors give tables illustrating the end results of the various injuries. The percentage of retained globes with useful vision varied from 2.4 percent in the case of mutilating injuries to as high as 55.2 percent in the case of injuries by non-retained metallic agents. The extent of the injury had more prognostic significance than the site. There were no instances of sympathetic ophthalmia observed in spite of the fact that in 78 cases there was persistent uveal tract inflammation.

The authors conclude that the sulfonamides did not prove to be of striking value in preventing infection and that the prognosis of perforating injuries of the globe has not improved materially over the past 40 years in spite of advances in chemotherapy and improvement in surgical technic.

Phillips Thygeson.

Ershkovich, I. G. Tissue therapy of sequelae of ocular war injuries. *Oftal. Jour.* (Odessa), 1946, pt. 3, pp. 7-17.

This is an analysis of 250 cases of late sequelae of ocular war injuries treated at the Ukraine Eye Institute for long periods of time, in an effort to exhaust all possible therapeutic procedures for restoration of even a small fraction of visual acuity. Of 64 eyes of 58 patients with traumatic iridocyclitis, 38 had no form vision before the beginning of therapy, 25 had vision from counting fingers to 0.1, and only one eye had a visual acuity above 0.1. Of the 63 patients with vision below 0.1, 29 recovered a visual acuity of 0.1 to 1. Of 21 eyes with imperfect light projection 4 remained unimproved; in 2 eyes vision improved to normal light projection, in 3 to counting of fingers, and in the others to a slight but measurable visual acuity. It is significant that four apparently hopeless eyes in the subatrophic stage showed some improvement.

Twenty patients had profound damage to the vitreous, 14 as a result of a perforating injury, and six after contusion. Eleven eyes had an extensive exudate in the vitreous, which in six encapsulated an intraocular foreign body. Five had a retinal detachment. There was some improvement in 18 of them. The period of observation ranged from six weeks to four years.

Tissue therapy was strikingly effective as a postoperative measure in 26 out of 27 cases of posttraumatic sequelae. Of 67 patients with subatrophic eyes which would usually be enucleated, 32 were freed of invalidism by alternating courses of tissue therapy and surgical procedures.

Ray K. Daily.

Kashuk, M. E. Therapeutic use of autoclaved preserved tissue in the treatment of sequelae of military ocular injuries. *Oftal. Jour. (Odessa)*, 1946, pt. 3, pp. 17-20.

This is a report of a clinical investigation on 60 cases of traumatic ocular lesions, treated with implantation of sterilized preserved skin into a subcutaneous pocket behind the ear; and with implantation of sterilized preserved placenta into the subconjunctival sac. This therapeutic pattern had a definitely favorable effect on eyes with traumatic keratitis, traumatic purulent corneal ulcers, traumatic iridocyclitis, resistant to other forms of therapy, traumatic uveitis with vitreous opacities, and traumatic chorioretinitis. In nine out of 12 cases of traumatic optic atrophy visual acuity and the fields improved.

Ray K. Daily.

Khoroshina, A. G. Treatment of sequelae of ocular war injuries with preserved tissue. *Oftal. Jour. (Odessa)*, 1946, pt. 3, pp. 21-25.

A detailed analysis is reported of 15 patients treated with tissue therapy. The eyes were injured by mine or bomb explosions. Two eyes were damaged by contusions, and 14 eyes had perforating injuries. Most of these patients had been discharged from other hospitals after all other procedures proved futile. Objective improvement

and improved visual acuity was obtained in 12 eyes. In chronic iridocyclitis in subatrophic eyes the photophobia and irritative symptoms disappeared. Corneal leucoma became somewhat less dense, and in one eye a semitransparent transplant became transparent. Vitreous opacities were absorbed, and in optic atrophy the narrow arteries on the disk dilated.

Ray K. Daily.

Levkoieva, E. T. The regeneration of wounds of external membrane of the eye in the light of new pathologico-anatomical results. *Brit. Jour. Ophth.*, 1947, v. 31, June, pp. 336-361.

The author has studied sections from 6,000 eyes enucleated over a period of many years.

A clinical diagnosis of endophthalmitis is frequently disproved microscopically. Repeated hemorrhages occurring late are proof of constant irritation resulting from non-closed or badly closed wounds. The healing process and the fate of the perforated eye depends chiefly on the primary surgical treatment.

The author highly recommends direct apposition of wounds, and shows many photomicrographs of poorly approximated wounds when only the conjunctival flap of Kuhnt was used. Conjunctivoplasty closes the superficial layers but the deep edges are not brought into apposition. This encourages the excessive production of fibroblasts which results in a contracted scar, flattening of the wound area and an irritation of the eye, which is often difficult to differentiate clinically from sympathetic ophthalmia. In one clinic, proper suturing of all wounds of the cornea and sclera reduced the frequency of enucleations by 8.9 percent. (14 photomicrographs.) O. H. Ellis.

Paufique, L. Head of the femur implants after enucleation. *Ann. d'Ocul.*, 1947, v. 180, March, pp. 129-139.

Inert organic substances which have been used as implants are discussed in detail. The head of the femur of infants that died at the age of three to four months is considered the most desirable implant in Tenon's capsule. After removal, it is immediately placed in 20 percent formalin for eight hours and then in water for four hours. It is then placed successively in 40, 60, and 80 percent solutions of alcohol and at the end of eight hours in 95 percent alcohol. One-half hour before use it is put in normal salt solution. The proximal or spherical surface is forward and the cut end backward. Two catgut sutures are inserted in the anterior surface, one above and the other below the mid-line. The implant is placed in the muscle cone and the muscles sutured over it vertically and horizontally. The implant sutures are tied over the superior and inferior recti tendons. Tenon's capsule and the conjunctiva are sutured over the implant and muscles. The above technique may also be used to improve the appearance of prostheses when simple enucleation had been done. Through a linear undermining incision in the lower conjunctiva the implant is inserted and sutured in position. (24 references.)

Chas. A. Bahn.

Scripchenko, C. P. Tissue therapy of war invalids. *Oftal. Jour.* (Odessa), 1946, pt. 3, pp. 25-29.

The tabulated data of the visual acuity of war-blind persons at the end of the treatment, which consisted of injections of extracts of leaves of aloes preserved in darkness, show definite, if minute improvement. Most responsive to this form of therapy are injuries of

the retina and choroid, and the treatment is least effective in methyl alcohol poisoning.
Ray K. Daily.

Somerset, E. J. Foreign body localization: the ring method. *Indian M. Gaz.*, 1947, v. 82, Feb., pp. 50-53.

An antero-posterior and a lateral X-ray film are taken on which the shadow of the ring will appear as a perfect circle and a line, respectively, if the films are properly placed in relation to the eye. Measurements are taken and transferred to a schematic drawing of the eye. Whatever the magnification of the X ray, the diameter of the ring is known to be 12 mm., and all other measurements can be adjusted by simple calculation. Irwin E. Gaynon.

17

SYSTEMIC DISEASES AND PARASITES

Agundis, Teódulo. Marfan's syndrome. *Anales de la Soc. Mexicana de Oft.*, 1947, v. 21, April-June, pp. 113-123.

Two cases encountered personally are recorded by the author. The first was in a young woman who was sent to the ophthalmic service of the City Hospital of San Luis Potosí, with absolute glaucoma of the right eye, the crystalline lens of which was opaque and dislocated up and inward. The left eye had normal tension, but showed a luxation of the lens similar to that of the right eye. There was notable lengthening of the extremities with arachnodactyly. The second patient was a man of 28 years, with lifelong poor vision. The crystalline lenses were displaced upward and outward. The right eye counted fingers at 70 cm., the left at 40 cm. The ophthalmoscopic description of the disc suggests very high astigmatism. The limbs were

notably longer than normal, there was arachnodactyly, and the nails of some fingers were atrophic and corrugated. X-ray examination of the cranium, the hands, and the thorax yielded signs of acromegaly, and also of aortitis and cardiac hypertrophy. (References.)

W. H. Crisp.

Castresana y Guinea, Angel. Ocular myiasis. Arch. de la Soc. Oft. Hisp.-Amer., 1947, v. 7, Feb., pp. 163-172.

A case of external ophthalmomyiasis, which is rare in Spain, occurred in a six-year-old child, in whom the larvae of oestrus avis were deposited in the conjunctival sac, while she was at play. A rapid inflammatory reaction of the conjunctiva and cornea ensued, and on examination numerous rapidly motile parasites were found and removed. Two small hemorrhages in the bulbar conjunctiva resulted either from direct trauma by the hooks of the parasite, or from a conjunctival necrosis produced by ferments of the parasite. The literature is reviewed, and the importance of early diagnosis is emphasized. Treatment consists in prompt extraction of the parasites, and the use of mercurial ointments. (2 illustrations.)

Ray K. Daily.

Franceschetti, A., and Bourquin, J. Rubella during pregnancy and congenital malformation of the infant. Ann. d'Ocul., 1946, v. 179, Dec., pp. 623-627.

Practically every expectant mother who has rubella during the first part of pregnancy must expect a malformed child. Among 479 infants of mothers that had measles during the first part of pregnancy, that have been reported there were included 274 cases of cataract and other ocular malformations, 52 of microphthalmus, 215 of deafness,

and 181 of cardiac malformation. Two types of cataract were observed; one central with transparent periphery and the other total, usually flat and membranous. Fundus pigment changes, especially in the macula, were frequently present. Five additional cases are described.

In pregnant women who have been exposed, immunizing serum should be used. The advisability of therapeutic abortion must be seriously considered.

Chas. A. Bahn.

Givner, I., Bruger, M., and Lowenstein, O. Exophthalmos and associated ocular disturbances in hyperthyroidism. Arch. of Ophth., 1947, v. 37, Feb., pp. 211-219. (See Section 13, Eyeball and orbit.)

Grammatico, A. D. Ophthalmologic contribution to the diagnosis and treatment of headache. Arch. de Oft. de Buenos Aires, 1946, v. 21, Aug., p. 219.

A chronic headache of many years resulted from vascular instability. The instillation of ergotropylin in the eyes together with thyroid therapy internally and adequate diet brought about a complete cessation of the headaches and a definite enlargement of the visual fields. (Tables, visual field charts, bibliography.) Plinio Montalván.

Graue, Enrique. A year in the Xoquiapan leprosarium. Anales de la Soc. Mexicana de Oft., 1947, v. 21, Jan.-March, pp. 23-30.

As titular ophthalmologist of the "Dr. Pedro López" leprosarium at Xoquiapan, about 22 miles from the City of Mexico, the author has studied the lesions of the disease in various parts of the eye. The usual population of this settlement varies between four and five hundred patients, concen-

trated by the Mexican Department of Public Welfare from various leprogenous zones of the Republic. The cornea is the tissue most frequently affected. The sclera, episclera, and iris follow and are almost alike in frequency of involvement. Some authors even believe that the eye is the usual portal of entry of the disease. W. H. Crisp.

Leriche, Rene. Surgical treatment of Sjögrens syndrome; the result, after 28 months, of bilateral section of the vertebral nerve. *La Presse Medicale*. 1947, no. 7, Feb. 1, pp. 77-78. (See Section 14, Eyelids and lacrimal apparatus.)

Paschkis, K. E., and Cantarow, A. Hyperophthalmopathic syndrome in thyroid disease. *J. Clin. Endocrin.*, 1947, v. 7, Feb., pp. 102-114.

The occurrence of proptosis, paresis of external ocular muscles, swelling of the lids, edema of the conjunctiva, and retrobulbar pain in patients with thyroid disease is discussed as the hyperophthalmopathic syndrome. The five case reports demonstrate that the pathologic physiology is not completely understood. Thyroidectomy should be avoided in potential severe ophthalmopathy. Severe ophthalmopathy, far out of proportion to the thyroid toxic manifestations, is a clear contraindication to thyroidectomy.

The effect of iodine should be studied and medication continued to produce the lowest possible basal metabolic rate. Where there is the slightest doubt operation is inadvisable.

The emergency treatment of ophthalmopathy consists of protection of the eyes by local measures followed by decompressing operations. Medical treatment is directed to suppression of excessive secretion of the anterior lobe

of the pituitary gland. Large doses of estrogenic hormones suppress pituitary function and the secretion of the thyrotropic hormone. Thyroid medication primarily suppresses the thyrotropic hormone. X-ray therapy of the pituitary gland attempts direct suppression of the over-active gland. (3 Figures.)

H. C. Weinberg.

Pedico, O. Orbital cysticercus. *Rassegna Ital. d'Ottal.*, 1947, v. 16, March-April, pp. 149-165.

Four stages in the development of the cysticercus which was present in the left orbit of a soldier, are described in detail. First there was slight discomfort and commencing impairment of ocular motility, then exophthalmos with marked chemosis of the conjunctiva, resulting from venous obstruction. In the third stage the tumor was palpable behind and above the globe. A fourth stage has been known, in which involvement of the accessory sinuses, cranial cavity and nasal fossae occur.

Aspiration of the mass gave a limpid fluid, containing hooklets, cells and a di-basic phosphate of calcium.

Eugene M. Blake.

Rosso, Silvio. The effect of estrogens upon the retinal arterial pressure. *Rassegna Ital. d'Ottal.*, 1947, v. 16, Jan.-Feb., pp. 3-16.

Rosso studied the retinal arterial pressure in patients with primary amenorrhea, follicular hypersecretion, dysmenorrhea, and normal menopause. After the patient was treated with various natural and synthetic estrogens further pressure readings were made. The estrogens have no effect upon people in hormonal equilibrium or where there is an estrogenic saturation. In primary amenorrhea there ex-

ists a marked sensitivity to the estrogen, which induces a retinal hypotension which lasts from a few hours to exhaustion of the supply of the hormone. (7 tables, 30 references.)

E. M. Blake.

Schmidtke, R. L. Hypovitaminosis A in ophthalmology. *Arch. of Ophth.*, 1947, v. 37, May, pp. 653-667.

The author has reviewed the literature of various experiments involving the use of vitamin A in the treatment of ocular diseases. He draws the following conclusions:

1. Hypovitaminosis A may exist in persons who presumably are receiving an adequate diet.

2. Even in the absence of demonstrable ocular lesions, poor dark adaptation is not presumptive evidence of vitamin A deficiency.

3. Fasting vitamin A levels of the blood are of value as a diagnostic aid in establishing the existence of a deficiency.

4. More reports on early ocular changes in vitamin A deficiency need to be made before biomicroscopic examination can be a real diagnostic aid.

5. The corneal and conjunctival lesions in vitamin A deficiency are probably neurotropic and result from degenerative changes in the trigeminal nerve.

6. Keratoconjunctivitis sicca is probably one of the many ways in which vitamin A deficiency manifests itself.

7. Some of the heretofore unexplainable ocular congenital anomalies are undoubtedly due to a vitamin A deficiency in the mother at some critical time during the period of gestation.

8. Vitamin A deficiency may be caused by (a) reduced consumption; (b) defective absorption; (c) unecological utilization and (d) excessive

utilization (1) during rapid growth, (2) during illnesses or (3) during pregnancy.

9. Parenteral administration of vitamin A is sometimes indicated.

10. Topical application of vitamin A is of doubtful value. (101 references.)

R. W. Danielson.

Solanés, M. P. The Vogt-Koyanagi syndrome. *Anales de la Soc. Mexicana de Oft.*, 1947, v. 5, Jan.-March, pp. 12-23. (See Section 7, Uveal tract, sympathetic disease, and aqueous humor.)

Speas, W. P. Some allergic manifestations of the eye. *N. Carolina M.J.*, 1947, v. 8, June, pp. 364-366.

The pathologic ocular manifestations of allergy include angioneurotic edema, blepharitis, conjunctivitis, and keratitis. Iritis, cyclitis, uveitis, endophthalmitis, and retinitis may follow drug therapy. Cataract, sympathetic ophthalmia and scintillating scotoma also may be induced by sensitivity to one or more offending agents. These may be mineral, vegetable or animal in origin. The diagnosis is made by a careful history, the use of skin tests, conjunctival tests, elimination tests and visits to the patients' environment.

Vernal conjunctivitis, the most common allergic ocular manifestation, occurs in the limbic type which is made up of phlyctenule-like vesicles at the limbus, and the palpebral type characterized by severe and persistent granulomas in the upper lid with a heavy viscid mucous discharge. Itching, lacrimation, redness, edema, scaling, and ulceration of the lids are the most common symptoms.

Treatment consists of removal of the offending allergens or of desensitization. General supportive treatment is advised with the addition of calcium.

histaminase, vitamins, and a salt free diet. Irrigations of the eyes with saline solution and the instillation of vasoconstricting drugs and cold compresses offer comfort to the patient.

H. C. Weinberg.

18

HYGIENE, SOCIOLOGY, EDUCATION AND HISTORY

Alvaro, M. E. **Organized ophthalmology.** Arch. Chilenos de Oft., 1946, v. 2, July-Oct., pp. 219-225.

The author's address emphasizes the educational value of frequent medical meetings for the exchange of ideas and report of special cases. He commends the standardization of hospitals accomplished by the American College of Surgeons, and advises for the South American countries better undergraduate teaching of ophthalmology and more systematic training of those graduates who intend to follow the specialty.

W. H. Crisp.

Arruga, H. **Drawings of the fundus.** Arch. de la Soc. Oft. Hisp.-Amer., 1947, v. 7, Feb., pp. 117-125.

It is pointed out that illustrations convey more vivid impressions than descriptions, and attention is called to the inaccuracies in the size and position of peripheral lesions in drawings, due to the difficulty of transferring impressions of a concave surface to a flat drawing. Arruga uses water colors applied with a brush, and a spray gun. The combined use of the two methods is described in detail and the results illustrated with the beautiful fundus drawings, for which Arruga is well known. (11 illustrations.)

Ray K. Daily.

Cogan, D. G. **Aims and aids in the teaching of basic sciences in ophthalmology.** Arch. of Ophth., 1947, v. 37, April, pp. 428-432.

A basic science course in ophthalmology should aim primarily to lay a foundation for the appreciation of clinical ophthalmology. The course should be taken by a student just prior to his ophthalmic residency if possible, but in any case not during the residency. It is best that the teaching be done by persons who are actively working in the field of ophthalmology. Such persons are to be found almost exclusively in ophthalmic research centers. In so far as there are few ophthalmic centers with personnel trained in basic sciences, the courses, at present, should be given in only a limited number of places. The classes should be sufficiently large, however, to supply the residents for the many clinical institutions which do not have the basic science facilities.

The following subjects are suggested: anatomy, histology and embryology; physical and physiologic optics; physiology and biochemistry; neuroanatomy and neurophysiology; bacteriology; pharmacology and toxicology; ophthalmic instrumentation.

John C. Long.

Heath, Parker. **Medical assistance at professional level.** Amer. Jour., Ophth., 1947, v. 30, August, pp. 992-994.

Lindner, K. **New things in ophthalmology.** Wien. Klin. Wchnschr., 1947, v. 59, May 2, pp. 265-267.

The author reviews recent progress in a postgraduate course. He stresses the importance of the discovery of Ascher that there are vessels near the limbus filled with clear liquid which flow into the neighboring veins. Pressure on the veins fills these vessels and Schlemm's canal with blood. Bailliard's method of measuring the blood pres-

sure in the central retinal artery and the difference between retinal (and intracranial) pressure on one hand and general blood pressure on the other are discussed. Hruby's accessory lens for investigation of the posterior vitreous with the slitlamp is described. Rieken contributed a method to measure adaptation objectively. The sulfonamides and penicillin enlarged our therapeutic possibilities, the former especially against trachoma and gonorrhoeic ophthalmia, the latter against gonorrhoea and staphylococcal infections. Serpiginous ulcer is effectively treated by rubbing a 20-percent zinc sulfate solution into the cornea. Lindner successfully used Elliot trephining in serpiginous ulcer. The most frequent surgical intervention against glaucoma now is iridencleisis. Desperate cases may respond to cyclodiathermy of Vogt. Cataract surgery advanced with the development of the intracapsular extraction and corneo-scleral sutures. Early removal of infected lenses after perforating injuries is recommended. Shortening operations by excision or partial excision of the sclera aid in certain cases of detachment. Sato describes a method for improving keratoconus by incising the cornea from behind, followed by pressure bandage. Lindner also discusses his new theory of the development of simple as well as high myopia. He bases his theory on the metabolism of the eye during different working conditions, and especially stresses the importance of the extravasation of a tissue-softening serumprotein. These products of the metabolism may be detrimental to the structures of the suprachoroid and sclera which may also have an inherited anatomical weakness.

Max Hirschfelder.

Mercier, A. *Ophthalmology and aviation*. Arch. d'Opht., 1946, v. 6, no. 4, pp. 413-435.

This report is a review of the relationships between ophthalmology and military and civilian aviation. Among the subjects considered in relation to their function in aviation are visual acuity, visual aptitude, night vision, heterophoria, visual fields, effects of acceleration and deceleration on vision, altitude effects, glare, effect of vibration, and chemical intoxications from gasoline vapors, carbon monoxide, and other poisons.

The author discusses in some detail the visual standards for the various classifications of pilots and observers. The bibliography includes 60 pertinent references covering the entire field of aviation ophthalmology.

Phillips Thygeson.

Onfray, R. *Centenary of Edmond Landolt, founder of the Archives d'Ophtalmologie (1846-1926)*. Arch. d'Opht., 1946, v. 6, no. 4, pp. 460-468.

This biographical sketch was inspired by the one hundredth anniversary, on the 17th of May, 1946, of the birth of Aarau Edmond Landolt, one of the great pioneers of ophthalmology. Born in Switzerland, Landolt was the son of a professor of philosophy in a Protestant seminary in Basle. Landolt received his doctorate in medicine from the University of Basle in 1868 and entered Horner's clinic at Zurich the following year. After the War of 1870, in which he took part as a member of the Swiss ambulance service, Landolt studied at Heidelberg with Helmholtz, then in Holland with Donders and Snelling. He then migrated to Paris where he very soon became a leader in ophthalmology. In 1882 he founded,

with Panas and Poncet, the Archives d'Ophthalmologie. Author of a great number of ophthalmological studies from 1880 to 1925, he is remembered particularly for the development of numerous optical and surgical instruments and for the surgical treatment of strabismus. He represented the best in French ophthalmology and left an indelible imprint on the science.

Phillips Thygeson.

Roper-Hall, M. J. Research in Zurich. Brit. Jour. Ophth., 1947, v. 31, April, pp. 223-228.

The author presents a summary of the work done at Zurich on the pathologic changes in the aqueous humor and the blood-aqueous barrier. Over 1900 anterior chamber punctures were done on normal and diseased eyes. The origin of the cells, increased in inflammation, was proved to be the blood and neighboring tissues. The predominant role of the reticulo-endothelial system in a great number of cases of chronic uveitis was noted. Albumin was increased in proportion to the number of cells, and in chronic inflammations a dissociation between the albumins and the cells was found, comparable to that observed in abnormal cerebrospinal fluid. Cultures were rarely positive even with strongly positive smears, and tubercle bacilli were found in only one case. Organisms found in the anterior chamber in keratitis and anterior uveitis were of etiologic significance.

The permeability of the blood-aqueous wall was studied with the intravenous fluorescein method. Trauma, uveitis, and most general diseases show an increased permeability; however the findings in glaucoma varied. It was found that the fluorescein test showed more minute changes in the permeabil-

ity of the wall than the Tyndall effect.
O. H. Ellis.

Rusconi, Carlos. Foramina in the orbital cavity of the pre-Spanish aborigenes of Mendoza. Arch. de Oft. de Buenos Aires, 1946, v. 21, Aug., p. 202.

The author studied the anatomy of the orbit in 56 skulls of pre-Spanish aborigenes of Mendoza, Argentina. Several anatomical variations were found, among them an orbital index of 80 to 108.3, the presence of an infra-orbital plate and a supernumerary supraorbital foramen.

Plinio Montalván.

Sbarski, S. I. Ocular war injuries in World War II and the organization of special services in the army. Oftal. Jour. (Odessa), 1946, pt. 3, pp. 36-40.

The following conclusions emerge from an analysis of the ocular injuries in an army hospital for special services. War injuries produce grave ocular damage, and cause blindness in 65 percent of the injured eyes. Surgical procedures at the front comprise closure of the ocular wound, enucleation, and lid repair. The eye service should be organized in connection with other special services, because isolated eye injuries are less frequent than combined injuries. Of the eyes with perforating injuries 40 percent had intra-ocular foreign bodies, and a powerful magnet is indispensable in an army special hospital. Ray K. Daily.

Sorsby, Arnold. Blindness in childhood—past achievements and present problems. J. Roy. Inst. Publ. Health and Hyg., 1947, v. 10, May, pp. 162-172.

Blindness due to neonatal infection and infectious diseases in early childhood has been reduced from 36.4 per

100,000 to 20.2 per 100,000 over a period of 22 years. This is due to the use of chemotherapy and antibiotics such as the Cr  d   technique, sulphonamides and penicillin. The passage of a law requiring a report of any purulent infection in a newborn younger than 20 days is also credited with causing this remarkable improvement.

The present problem is to reduce the causes of blindness due to congenital malformations of genetic origin, dietary deficiency in the mother, intrauterine infections, trauma, and also those caused by biochemical changes. Maternal infection has been underestimated and genetic anomalies are also stressed as causes of blindness in early childhood. (3 tables.)

H. C. Weinberg.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Bein, H. J. Hereditary aplasia of the optic nerve in mice. *Ophthalmologica*, 1947, v. 113, Jan., pp. 12-37.

A famous strain of waltzing mice, kept going by selective breeding, has been under observation at the Department of Anatomy of the University of Basle since 1938. In 1942 the author, in the course of the anatomical examination of an animal from this strain, discovered aplasia of both optic nerves, the chiasm, and both optic tracts. This finding called the author's attention to the occurrence of congenital anomalies of the visual pathway (with or without anomalies of the eyeball or of the ocular adnexa) in waltzing mice. The anatomical findings in three such animals are the basis of the paper under review. Variations as to the degree and extent of the anomaly also occurred. Only a small percentage of the waltz-

ing mice showed gross congenital anomalies of the peripheral or central visual apparatus. The animals with gross anomalies of the visual system did not differ in their behavior from the waltzing animals with normal visual systems. The visually defective ones waltzed with the same endurance, poise and skill as the visually normal animals. Obviously, the congenital anomalies described in the paper did not constitute the specific cause of the waltzing. The presence of congenital visual anomalies could be recognized *in vivo* by biomicroscopy of the anterior segment of the eye or by ophthalmoscopy. The clinical eye findings will be reported by R. Brueckner. By selective breeding, the author has succeeded in perpetuating the congenital anomaly of the visual system.

Peter C. Kronfeld.

Cooper, E. R. A. The trochlear nerve in the human embryo and fetus. *Brit. Jour. Ophth.*, 1947, v. 31, May, pp. 257-275.

In this very comprehensive article, Cooper attempts to answer three puzzling anatomical questions concerning the trochlear nerve. These are: why does the nerve decussate? Why is the decussation on the dorsal aspect of the brain stem? How does the nerve reach the dorsal position where it decussates? The latter two questions are answered while the first remains unanswered. Through well presented microphotographs of serial sections of numerous embryos from 4 mm. (3 to 4 weeks) onward the embryological processes of the nerve and its nucleus are pictured.

The trochlear nucleus originates in series with the oculomotor nucleus but in the basal plate of the isthmus. As the lateral walls of the isthmus link the metencephalic alar to the mesen-

cephalic basal plates, the basal plate of the isthmus becomes compressed until it assumes a position at the ventral extremity of the lateral wall of the isthmus, and it is here that the trochlear nucleus is situated at first. The fibers from the nucleus immediately form a bundle which turns dorsally at once and thus gains an alar situation in the lateral wall of the isthmus caudally to the superior medullary velum where the decussation occurs. The nerve becomes a compact bundle as it leaves its nucleus and remains so; the decussation is a simple crossing of these two bundles and is not an intermingling of the fibers as in the case of the optic nerves. (11 illustrations.)

Morris Kaplan.

Evans, John N. The capillary sphincter in the human retina. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 182-188.

Microscopic studies of surface preparations of retina and choroid showed a peculiar abrupt narrowing of certain capillaries where they joined the vessel of the next larger order. This narrowing is considered to be of a purely histologic nature due to a sphincter-like action in this region. Some capillaries did not show this narrowing.

If retinal and choroidal capillary sphincters do exist, their contraction would have a powerful effect on the capillary bed. It is conceivable that a derangement of this sphincter mechanism by disturbance of the sympathetic

hormonal relations might be a factor in producing a type of glaucoma simplex. It might seem reasonable to conclude that the retinal capillary aneurysms associated with glaucoma may have their origin in a prolonged constriction of the sphincter muscle. (4 photomicrographs.) John C. Long.

Gartner, Samuel. Cyclopia. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 220-231.

Cyclopia is a congenital anomaly but is not hereditary, since life is impossible. Its development depends on local factors acting on the midline structures of the face at or before the time of development of the anlagen of the eyes. Two cases of cyclops are reported. In one case the eye was a true single median eye; in the other, a fused double eye. The importance of the pigment epithelium in the development of the choroid, as well as its influence on the retina, is indicated by this study. In both cases the absence of pigment epithelium was associated with almost complete absence of the choroid, the choriocapillaris and the lamina vitrea and by maldevelopment of the overlying retina. In one case a misplaced island of retina was observed buried in the choroid and sclera, in an area where pigment epithelium was lacking. Some proof was found that this anomaly was due to metaplastic development of the pigment epithelium into a retinal type of structure. (14 photographs.)

John C. Long.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. John Conrad Holzberger, Brooklyn, New York, died May 31, 1947, aged 54 years.

Dr. Olaf Martin Steffenson, Chicago, Illinois, died June 3, 1947, aged 68 years.

Dr. George Loring Tobey, Jr., Boston, Massachusetts, died May 20, 1947, aged 65 years.

Dr. Harry W. Woodruff, Joliet, Illinois, died June 20, 1947, aged 79 years.

ANNOUNCEMENTS

EYE LABORATORY FOR LOS ANGELES

The Estelle Doheny Eye Foundation announces the establishment of an eye laboratory located at St. Vincent's Hospital in Los Angeles, designed to provide certain modern ophthalmic facilities badly needed in southern California.

The immediate functions of the laboratory are:

1. To serve as a pathologic laboratory for the diagnosis and registration of pathologic specimens, with preparation of gross specimens and microscopic slides for ophthalmologists submitting specimens, and for the building up of a museum of eye pathology.

2. To serve as a bacteriologic laboratory where diagnostic scrapings, smears, and cultures can be studied, animal inoculations can be made, and the sensitivity of organisms to various drugs and antibiotics can be determined.

3. To provide facilities for fundus, gross, and slitlamp photography, and to maintain a library of photographs and motion pictures for teaching of ophthalmology.

4. To provide an Eye Bank for southern California, with registry of potential donors and recipients. Donor material will be collected, examined, and distributed, and facilities may later be provided for limited instruction in corneal transplant procedures.

5. To distribute and loan certain drugs and equipment that are not otherwise available in the community.

6. To make available certain special equipment for radiation therapy of the eye for use outside the laboratory.

Dr. Alan C. Woods, professor of ophthalmology, Johns Hopkins Medical School; Dr. Cecil O'Brien, professor of ophthalmology, University of Iowa Medical School; and Dr. Phillips Thygeson, formerly professor of ophthalmology, Columbia University, and now associate professor of ophthalmology, University of California, will serve on the advisory board. Dr.

A. Ray Irvine, professor of ophthalmology, University of Southern California, will act as chairman of the original board. It is contemplated that the advisory board will also include prominent business and professional leaders as well as representatives from the eye departments of local hospitals, medical schools, and the Eye Section of the Los Angeles County Medical Society.

Dr. Peter Soudakoff, formerly associate professor of ophthalmology at the Peking Union Medical College, will serve as full time pathologist at the laboratory. It is planned that, as part of the residency program of the eye service of the Los Angeles County Hospital and certain local veterans' hospitals, that each resident will spend 2 or 3 months at the laboratory. It is anticipated that a research associate, granted a Fellowship in basic ophthalmic research by the Foundation, will be added to the laboratory staff from time to time.

In creating this perpetual charitable Foundation dedicated to the conservation and restoration of eyesight, Mrs. Edward Laurence Doheny, with great generosity and discerning wisdom, has been careful to insure a flexibility of organization to take care of the immediate practical needs and at the same time provide for eventual development of much needed research in ophthalmology.

GILL HOSPITAL GRADUATE COURSE

The Gill Memorial Eye, Ear, and Throat Hospital, Roanoke, Virginia, announces that its 21st annual spring graduate course in ophthalmology and otolaryngology will be held from April 5 through April 10, 1948.

Among the guest speakers in ophthalmology will be Prof. Adalbert Fuchs, UNRRA-WHO Shanghai, China; Dr. Conrad Berens, New York; Dr. A. D. Ruedemann, Wayne University Medical School, Detroit; Dr. Edwin B. Dunphy, Massachusetts Eye and Ear Infirmary, Boston; Dr. Trygve Gundersen, Boston; Dr. John M. McLean, New York; Dr. Alston Callahan, Medical College of Alabama, Birmingham.

MISCELLANEOUS

DARTMOUTH EYE INSTITUTE CLOSES

The Dartmouth Eye Institute, Hanover, has terminated all clinical activities "because of an inability to provide a sound financial basis for future activities," the managing trustee, John Pearson, has announced. The clinic was es-

published in 1921 when Prof. Adelbert Ames, Jr., undertook the study of problems of visual optics. The current work of Professor Ames in visible perception continues under the auspices of the Hanover Institute.

UNIVERSITY OF CINCINNATI APPOINTMENT

The University of Cincinnati College of Medicine has appointed Dr. Donald J. Lyle professor of ophthalmology and director of the Cincinnati General Hospital's Department of Ophthalmology.

STUDY OF CONGENITAL MALFORMATIONS

In an effort to collect more precise data on the relationships between certain maternal infections and congenital malformations, a nationwide study is being sponsored by the American Academy of Pediatrics and the National Society for the Prevention of Blindness. Questionnaires are being sent to obstetricians, ophthalmologists, and pediatricians, seeking the reporting of cases of German measles in expectant mothers and of children with congenital defects that might be attributed to other infections in the expectant mother, such as measles, chicken pox, mumps, and influenza.

Although an association has been established between the occurrence of German measles early in pregnancy and certain congenital defects in the offspring, information is lacking as to the frequency with which this happens and as to the possible influence of other communicable diseases that might have been contracted by the expectant mother.

Data will be studied by the following committee: Dr. Herbert C. Miller, professor of pediatrics, University of Kansas Hospitals, Kansas City, Kansas; Dr. Stewart Clifford and Dr. Clement A. Smith, both of Boston, Massachusetts; Dr. Josef Warkany, of Cincinnati, Ohio; Dr. James Wilson, of Ann Arbor, Michigan; and Dr. Herman Yannet, of Southbury, Connecticut. Physicians knowing of cases are urged to register them with Dr. Miller, chairman of the committee.

SOCIETIES

CENTRAL ILLINOIS MEETING

The eighth meeting of the Central Illinois Society of Ophthalmology and Otolaryngology was held at the Abraham Lincoln Hotel, Springfield, Illinois, on August 23rd and 24th. Mr. J. C. Copeland of the Riggs Optical Company, Chicago, gave four talks on: "Practical Session in Retinoscopy," "Practical Applications of the Spherical Equivalent Concept," "Methods of Overcoming Some Difficulties in Cross Cylinder Testing," and "Duochrome Refraction Methods." Other speakers were: Dr. Philip R. McGrath, Peoria, Illinois, who spoke on "Retrobulbar

Neuritis;" Dr. French K. Hansel, St. Louis, Missouri, "Allergy in Ophthalmology and Otolaryngology;" and Dr. Carson Gabriel, Quincy, Illinois, "Case Reports: Carcinoma of the Lung and Complete Atelectasis of Lung."

SEMINAR ON INDUSTRIAL VISION

A familiarization seminar on Industrial and Occupational Vision will be held the afternoon and evening of November 5, 1947, at the Van Cleve Hotel, Dayton, Ohio. The seminar is being sponsored by Zone 9, Ohio State Optometric Association and the Safety Council, Dayton Chamber of Commerce. The program will include:

2:30 P.M.—Introduction to theme—Occupational Vision; F. E. Billette, O.D., governor, Zone 9; R. N. Roth, O.D., seminar chairman.

3:00 P.M.—Accident Proneness and The Employee's Vision; N. C. Kephart, Ph.D., Assistant professor of Industrial Psychology, Purdue University.

3:30 P.M.—Industry and Seeing—One Aspect of Occupational Seeing; Joseph H. Tiffin, Ph.D., professor of Industrial Psychology, Purdue University.

4:00 P.M.—The Nurse in The Industrial Vision Program—Hazel H. Leedke, R.N., industrial nurse, Health Department, Thilmany Pulp and Paper Company, Kaukauna, Wisconsin.

4:30 P.M.—The Utilization of a Program of Employee Visual Classification, Correction, and Placement Within Our Plant. Richard Wampler, safety director, the Dayton Rubber Manufacturing Company.

5:00 P.M.—Some Aspects of a Plant Safety Goggle Program. William Carroll, director, Industrial Vision Department, White-Haines Optical Company, Columbus, Ohio.

The meeting is open to representatives of industry, and all members of the ophthalmic professions are invited to attend. A registration fee of five dollars per person will include the dinner. For registration write to R. N. Roth, O.D., 2324 Salem Avenue, Dayton 6, Ohio.

PERSONALS

ACCEPTS YALE APPOINTMENT

Dr. J. Alexander van Heuven, formerly of Utrecht, Holland, has been appointed assistant clinical professor of ophthalmology at the School of Medicine, Yale University. Dr. van Heuven will be associated in private practice with Dr. Eugene M. Blake, head of the department.

MOVES TO NEW OFFICES

Dr. Clement C. Clarke announces the removal of his offices to 240 Bradley Street, New Haven 10, Connecticut.

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VITREOUS INFECTIONS AND STREPTOMYCIN*

EXPERIMENTAL STUDIES

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Vitreous infections are fortunately not frequent. Nevertheless, they do occur and are extremely difficult to treat. They may occur as a result of bacteria spreading from other parts of the body or eye, following penetrating or perforating injuries, and after intraocular surgery. With the advent of the sulfonamides and penicillin impetus was given to experimental studies concerning vitreous infections.¹⁻³

There are certain principles that must be followed in treating vitreous infections with an antibacterial drug. In order for any chemotherapeutic agent to be effective it must be able to reach the infected tissue in adequate concentration. The organism responsible for the infection must be susceptible to the chemotherapeutic agent. When the therapeutic drug is present in the infected tissue in adequate concentration, it should not produce damage to the tissue.

Systemically administered sulfonamides will reach the vitreous humor in high concentrations⁴⁻⁷ and in such concentrations will not damage the vitreous body. However, when tried in a standard experimental infection, systemically administered

sulfonamide therapy usually failed.^{2,8,9} Direct intravitreal injections of sulfonamides as employed by von Sallmann and co-workers¹ were not successful in controlling experimental vitreous infections. There are, however, a few reports of direct intravitreal injections of sulfonamides controlling infection in human eyes.¹⁰ Direct intravitreal injections of sulfonamides produce vitreous, retinal, and choroidal damage.^{8,11}

Penicillin has been shown to penetrate poorly from the blood stream into the vitreous humor^{3,12-16} of the normal and inflamed eye. Corneal baths, corneal iontophoresis, subconjunctival and anterior-chamber injections produced higher intravitreal concentrations of penicillin than did the systemic route.^{3,12,13} However, although these local measures and massive systemic doses had some success in controlling experimental vitreous infections, not one was as effective as direct intravitreal injections of penicillin.^{1-3,16,26}

Direct intravitreal injections of penicillin occasionally produced vitreous opacities, retinal and choroidal degeneration around the sites of injections. Some eyes, so injected, showed only temporary alterations of structure similar to those following normal saline injections. Clinical cases are beginning to appear in the literature in which vitreous infections have been successfully treated by direct injections without producing untoward dam-

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age.¹⁷ In some hands, experimental intravitreal penicillin injections have proved quite damaging, but this has been attributed to an impure form of penicillin.¹⁸ Five thousand units of purified penicillin in 0.1 cc. of water have been placed in the vitreous with little subsequent reaction and no ophthalmoscopically visible

TABLE 1

VITREAL CONCENTRATIONS OF STREPTOMYCIN FOLLOWING SUBCONJUNCTIVAL, ANTERIOR-CHAMBER AND DIRECT INTRAVITREAL INJECTIONS

Micrograms per cc. of Vitreous Humor		
Time after injection	30 Min.	120 Min.
<i>Subconjunctival Injection</i>		
Rabbit	O.D.	O.S.
1	3 μ g./cc.	3 μ g./cc.
2	1 μ g./cc.	3 μ g./cc.
3	trace	5 μ g./cc.
<i>Anterior-Chamber Injection</i>		
	O.D.	O.S.
4	trace	20 μ g./cc.
5	15 μ g./cc.	25 μ g./cc.
6	10 μ g./cc.	15 μ g./cc.
<i>Vitreous Injection</i>		
	O.D.	O.S.
7	70+ μ g./cc.	70+ μ g./cc.
8	70+ μ g./cc.	70+ μ g./cc.
9	70+ μ g./cc.	70+ μ g./cc.

changes.²⁶ Because of the possibility of damaging the intraocular structures of the posterior segment with commercially available penicillin, ophthalmologists hesitate to use such therapy. Less damaging procedures are usually tried first and intravitreal injection used only as a final hope.

Because it has been shown that streptomycin penetrates poorly from the blood stream into the normal vitreous humor,¹⁹ it is likely that local administration of streptomycin will have to be used in therapy of vitreous infections. Studies of vitreous-humor concentrations following local methods of administration of streptomycin have not as yet been reported, and are included in this present paper.

EXPERIMENTAL STUDIES

PART 1

Streptomycin was administered subconjunctivally. It was also injected directly into the anterior chamber and directly into the vitreous humor. Blue-eyed chinchilla rabbits weighing between 3 to 4 kilos were used. Six normal eyes were used for each type of injection. Subconjunctival injections were made with 100,000 micrograms/0.2 cc. of normal saline and vitreous injections with 100,000 μ g./0.1 cc.

Direct anterior-chamber injections were made with 100,000 μ g./0.1 cc. The anterior chamber was punctured and approximately 0.1 cc. of aqueous humor was drawn into the syringe containing 100,000 μ g. in 0.1 cc. and approximately 0.1 cc. of the syringe mixture was reinjected into the anterior chamber. In this way approximately 50,000 μ g. were placed into the anterior chamber.

Vitreous humor specimens for each type of administration were withdrawn at 30 minutes after injection in three eyes and after two hours in three eyes. Specimens were analyzed by the method described by Stebbins and Robinson²⁰ using their strain of staphylococcus aureus.

The results of these studies are recorded in Table 1. It is evident that anterior-chamber injections produce higher concentrations than the subconjunctival route⁸ in the vitreous humor of the normal eye. This had been shown previously to occur with penicillin.³ All these methods of local administration of streptomycin produced higher intraocular concentrations than those reported for the usual systemic doses.¹⁹

Subconjunctival injection was always followed by marked local injection and chemosis that largely subsided in 8 to 12 hours. Anterior-chamber injection produced conjunctival edema, pericorneal in-

jection, and signs of iritis. Most of these changes disappeared in 36 to 48 hours. In one rabbit, lenticular opacities developed. Because of these lens changes the anterior chambers of six additional eyes were injected with concentrations of streptomycin ranging from 5,000 to 100,000 units per injection. Care was taken not to inject the material with excess force and to be certain that the needle did not touch the lens. In none of these did any permanent lens changes develop.

Posterior-segment injections were made with concentrations ranging from 40 to 100,000 μ g. in 0.1 cc. into 12 rabbit eyes. The results are listed in Table 2. All produced clouding of the vitreous humor. The globe became red and vitreous opacities developed. Slight clouding of the cornea occurred temporarily for a few hours after each injection and was probably due to a temporary increase in intraocular pressure. After two days large white areas could be seen in the retina around the site of injection in all six eyes that received 5,000 to 100,000 units per injection. These were areas of retinal and choroidal exudation which gradually changed to patches of degenerated tissues. These patches were localized to the side of the original site of injection except in the eye that received 100,000 units. Here the entire posterior segment was involved, preventing a view of the fundus.

It is thus apparent that intravitreal injections of streptomycin produced damage similar to that seen with penicillin. However, it is noteworthy that concentrations below 800 μ g. of streptomycin can be injected with very little subsequent reaction similar to that seen following the injection of normal saline alone.

Anterior-chamber injection of streptomycin produced no permanent damage and did provide levels that might prove helpful in controlling vitreous infections. Anterior-chamber injections of penicillin

TABLE 2
RESULTS OF POSTERIOR-SEGMENT INJECTIONS
OF VARIOUS CONCENTRATIONS

Rabbit No.	Micrograms of Streptomycin per Injection	Ocular Reaction
1	100,000	Exudation and later organization of posterior segment No fundus view
2	50,000	Exudation and later degeneration of retina and choroid on side of injection
3	20,000	Exudation and later degeneration of retina and choroid on side of injection
4	10,000	Exudation and later degeneration of retina and choroid on side of injection
5	10,000	Exudation and later degeneration of retina and choroid on side of injection
6	5,000	Exudation and later degeneration of retina and choroid in quadrant of injection
7	3,000	Exudation and later degeneration of retina and choroid in quadrant of injection
8	1,500	Exudation and later degeneration localized about site of injection
9	800	No reaction except immediately at site of injection
10	400	No reaction except immediately at site of injection.
11	200	Slight exudation in addition to damage at site of injection
12	40	No reaction except for damage at site of injection

were not as successful in controlling experimental vitreal infections as the direct intravitreal injection technique.³ One hesitates to disturb the integrity of an eye by any sort of intraocular injection unless he is certain that the diagnosis is correct, that the infection will respond, and that matters will not be made worse by such therapy. Corneal iontophoresis and subconjunctival injection can give high concentrations in the anterior chamber but not as high as those reached by direct anterior-chamber injection. It apparently requires very high anterior-chamber concentrations of drugs such as streptomycin and penicillin in order for them to pass posteriorly through the iris-lens barrier. In an effort to find another method by

which these antibiotics could reach the vitreous without direct intraocular injection, further studies with iontophoresis were undertaken.

TABLE 3

CONCENTRATION OF PENICILLIN IN VITREOUS HUMOR FOLLOWING RETROBULAR INJECTIONS AND RETROBULAR INJECTIONS PLUS IONTOPHORESIS

Units per cc.			
Retrobular Alone		Retrobular plus Iontophoresis	
30 Min.	120 Min.	30 Min.	120 Min.
0	0	.3	.3
0	0	.3	.3
0	0	.5	.3
0	0	.3	.4

It is known that ions do not pass through circulating fluid and it is assumed that they are carried away by such fluid. This explanation has been applied to the vascular sponge of the choroid. It had been accepted generally that ions could not be introduced into the posterior segment of the eye through the choroid.^{21, 22} However, this hypothesis has been disproved recently by von Sallmann.^{23, 24} He reported driving anions through the sclera, choroid, and retina into the vitreous. For these reasons studies were run to determine the ability of penicillin and streptomycin to penetrate the posterior segment of the eye when aided by iontophoresis.

PART 2

Instead of applying electrodes directly to the sclera, the antibiotics were injected retrobulbarly and a glass electrode was applied over the corneal surface. The corneal electrode was filled with normal saline and the positive pole attached to it. The negative electrode was placed behind the neck. These poles were reversed for streptomycin. A current of 3 to 5 milliamperes was applied for five minutes and the vitreous humor specimens withdrawn

for analysis at 30 minutes and two hours. Penicillin analyses were done by the technique described by Rammelkamp,²⁵ and streptomycin according to the Stebbins and Robinson²⁰ method. Fifty-five thousand units of penicillin in 2 cc. of saline were injected retrobulbarly and 200,000 units of streptomycin in 2 cc. of saline. The results are recorded in Tables 3 and 4.

It is evident that retrobulbar injection

TABLE 4

CONCENTRATION OF STREPTOMYCIN IN VITREOUS HUMOR FOLLOWING RETROBULAR INJECTIONS AND RETROBULAR INJECTIONS PLUS IONTOPHORESIS

Micrograms per cc.			
Retrobular Alone		Retrobular plus Iontophoresis	
30 Min.	120 Min.	30 Min.	120 Min.
0	0	trace	12
0	trace	12	15
0	0	15	13
0	0	13	15

plus iontophoresis did aid the penetration of each antibiotic into the vitreous humor.

The levels for streptomycin are approximately the same as those following anterior-chamber injection (see table 1). Vitreous concentrations of penicillin were likewise similar to those reached by anterior-chamber injections according to an earlier report.³ Following retrobulbar injections considerable chemosis and injection of the globe occurred. This reaction subsided within 8 to 12 hours. Iontophoresis of the duration and strength used produced slight, temporary clouding of 5 of 16 corneas but no permanent change.

PART 3

To determine the relative efficiency of these methods against vitreal infection the following studies were undertaken: 0.1 cc. of a diluted 18-hour broth culture of B. coli (100,000 organisms per cc. in-

TABLE 5

VITREOUS INFECTIONS DUE TO 1,000,000 BACTERIA-COLI ORGANISMS AS INFLUENCED BY VARIOUS FORMS OF LOCAL STREPTOMYCIN THERAPY

Type of Therapy	No. of Eyes	No. of Eyes Degenerated in 3 weeks	No. of Eyes Degenerated in 4 months
1. No Therapy	6	6	
2. Intravitreal Injection	6	0	6
3. Anterior-Chamber Injection	6	2	4
4. Retrobulbar Injection	6	6	
5. Retrobulbar Injection plus Iontophoresis	6	0	6

hibited by 3 μ g. of streptomycin per cc.) was injected into the vitreous humor of 30 eyes. There were approximately 1,000,000 organisms in each injection. Within 30 minutes after injection of the organisms, 100,000 μ g. of streptomycin in 0.1 cc. were injected into the vitreous of six eyes. Six eyes received 100,000 μ g. of streptomycin in the anterior chamber. Twelve eyes were injected retrobulbarly with 200,000 units of streptomycin in 2 cc. of saline. Six of the eyes with retrobulbar injections of streptomycin were treated also with iontophoresis. The negative pole was placed on the corneal glass electrode as in the experimental studies mentioned above. The same current and time for iontophoresis were used as in the preceding experiment. Six eyes had only injections of the organism and no streptomycin therapy. All eyes received daily atropine drops to facilitate ophthalmologic examination.

These studies were then repeated using 20,000 organisms per injection.

(table 6). Six eyes were used for each type of therapy and six received no streptomycin.

The untreated eyes receiving 1,000,000 organisms showed marked vitreous abscesses in 16 hours that extended rapidly into the anterior chamber and caused complete degeneration of the eye within 2 to 3 weeks. The untreated eyes that received approximately 20,000 organisms showed vitreous abscesses that spread to the anterior segment in 5 to 7 days and gradually degenerated to phthisis bulbi in 4 to 5 weeks.

Not one of the treated eyes that received 1,000,000 organisms recovered (see table 5). Those that were injected directly into the vitreous with the streptomycin showed a fairly localized vitreous abscess for the first 5 to 7 days but these gradually extended and the eyes degenerated slowly during the next four months.

The six eyes treated with retrobulbar injections of streptomycin alone were completely degenerated within 2 to 3

TABLE 6

VITREOUS INFECTIONS DUE TO 20,000 BACTERIA-COLI ORGANISMS AS INFLUENCED BY VARIOUS FORMS OF LOCAL STREPTOMYCIN THERAPY

Type of Therapy	No. of Eyes	No. of Eyes Degenerated in 5 Weeks	No. of Intact Quiet Eyes after 4 months
1. No Therapy	6	6	0
2. Intravitreal Injection	6	0	6
3. Anterior-Chamber Injection	6	0	3
4. Retrobulbar Injection	6	6	0
5. Retrobulbar Injection plus Iontophoresis	6	0	4

weeks. The six eyes treated with retrobulbar streptomycin injections plus iontophoresis showed localized vitreous abscesses for the first week and then gradually degenerated within the next 5 to 6 weeks.

Eyes treated with anterior-chamber injections varied. Three of the eyes required 5 to 6 weeks for degeneration and three degenerated within 2 to 4 weeks.

In the eyes infected with 20,000 organisms, intravitreal injection controlled all six so treated. These all showed vitreous abscesses that did not extend but remained localized and subsequently organized allowing only a partial view of the fundus. The vitreous never completely cleared but after four months the anterior segments were clear and the globe maintained its form and intraocular pressure.

Four of the eyes treated with retrobulbar streptomycin plus iontophoresis showed a partial fundus view, an intact globe, and quiet anterior segment after four months. The other eyes were soft and degenerated by the fourth month. None of the eyes treated with retrobulbar streptomycin alone differed from the control eyes.

Three of the eyes that received streptomycin in the anterior segment were still intact after four months but only a narrow view of the fundus could be obtained. The anterior segment was quiet and the intraocular pressure not lowered. One eye maintained its shape and intraocular pressure and had a clear anterior segment. Aside from a faint red reflex, no fundus details could be seen in this eye. The other eyes degenerated within two months.

These results indicate that intravitreal injection, retrobulbar injection plus iontophoresis, and anterior-chamber injection of streptomycin all lessened the severity of the infectious process. When fewer organisms were used, these forms

of therapy were more successful. In this small series, direct intravitreal injections of streptomycin were superior to the other methods. Retrobulbar streptomycin plus iontophoresis was slightly better than direct anterior-chamber injection.

Although these results are not absolute, they do suggest that retrobulbar streptomycin plus iontophoresis may aid in controlling vitreous infections.

The experimental data concerning vitreous infections shows that the best results are obtained when therapy is instituted early^{1, 2} before the infection can become firmly established and the vitreous disorganized. In eyes in which there is a doubt concerning the severity of the posterior-segment infection, when one cannot be certain that the vitreous infection will be overwhelming, one may hesitate about using direct intravitreal injection of an antibiotic because of the possible damage from such an injection.

In such eyes some form of local administration of penicillin or streptomycin should be employed. One should not rely solely on massive systemic doses of penicillin or streptomycin.²⁷ The local routes that may be employed are subconjunctival injection, anterior-chamber injection, and retrobulbar injection plus iontophoresis.

It must be pointed out that these procedures have not been tried in human eyes. Also, not one of these forms of therapy was repeated in the above experiments. It is possible that daily repetition of anterior-chamber or retrobulbar injection plus iontophoresis may have been more effective.

CONCLUSIONS

1. Retrobulbar injections of streptomycin and penicillin plus iontophoresis produced vitreous-humor concentrations equal to that reached with direct anterior-chamber injections and superior to those

following subconjunctival injection.

2. Direct intravitreal injection of streptomycin, retrobulbar injection plus iontophoresis, and anterior-chamber injections reduced the severity of experimental vitreous infections due to bacteria coli. They were effective in the order listed.

3. Direct intravitreal injections of streptomycin produced retinochoroidal exudation and subsequent degeneration. In concentrations below 800 μ g. per injection, the damage was minimal and limited to the site of injection.

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PIGMENTATION OF THE PALPEBRAL CONJUNCTIVA RESULTING FROM MASCARA*

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Several years ago, during the course of a routine examination of a middle-aged woman, a granular, stippled pigmentation was noted under the palpebral con-

months, the condition showed no appreciable change and a drawing was made (fig. 1). The pigmentation was situated at each extremity of the tarsus on a level

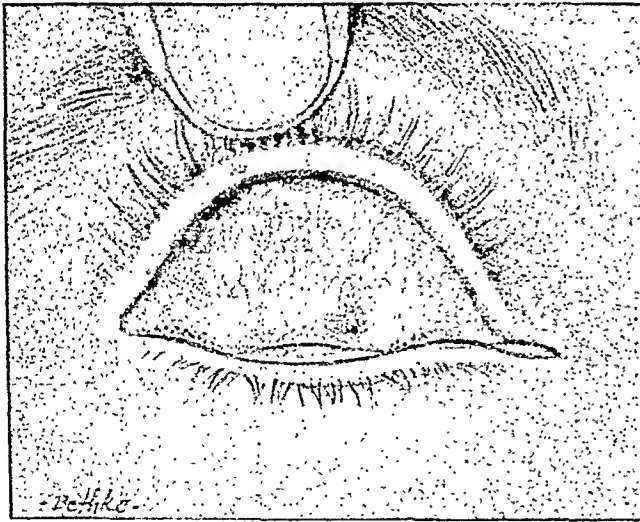


Fig. 1 (Reese). A stippled pigmentation situated at each extremity of the tarsus on a level with its upper border.

junctiva of both upper lids. The nature of the lesion was not known and no clue was obtained as to its cause. After 10

with its upper border. It was located under the conjunctiva rather than in the conjunctiva. Over the pigmented area there was a folliculosis and slight congestion. The condition was identical in both lids. After 2½ years, there had been some extension of the pigmentation and another drawing was made (fig. 2). At each extremity of the tarsus, and particularly at the temporal end, the pigmented area had broadened and had extended horizontally so that it could be seen as a narrow line along the upper border of the tarsus, fading out in the central portion. In addition, a mottled, deep-seated, bluish-black pigmentation could be seen rather faintly under the conjunctiva of the lower lid.

During the period this case has been followed, six additional cases have been observed. Except for minor variations they have all been of similar pattern.

* Read at the 82nd annual meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.

The location is always the same, varying only in that some are more pronounced at each extremity of the tarsus (fig. 3), and particularly the temporal extremity, while others manifest themselves mostly along the upper border of the tarsus. The color varies from black to a dirty light brown. The pigment is situated under the conjunctiva and always has a granular appearance. Under higher magnification it can be resolved into irregular punctate dots. There is always an associated folliculosis. The symptoms referable to the condition are mild if any. Symptoms that the patients gave having possible connection with the lesion are: burning, redness, and itching of the eyes, feeling of sleepiness, roughness and swelling of the lids, and desire to blink the eyes excessively. All of the patients were women ranging in age from 31 to 55 years.

Biopsy material was removed from the most marked case (fig. 3) at a site lateral to the tarsus. The hematoxylin and eosin stain (fig. 4) showed accumulations of black amorphous pigment in follicles and in the stroma under the follicles. The pigment granules were located in or upon stroma cells or were free in the tissue. They were not in macrophages or giant cells and therefore had excited no foreign-body reaction. There was no pigment in the conjunctiva, and no granules could be detected making their way through the epithelium. The follicles were composed of lymphocytes and plasma cells. Bleached sections (fig. 5) showed the pigment unaffected. Sections on which the Turnbull stain was employed showed that the pigment contained no iron.

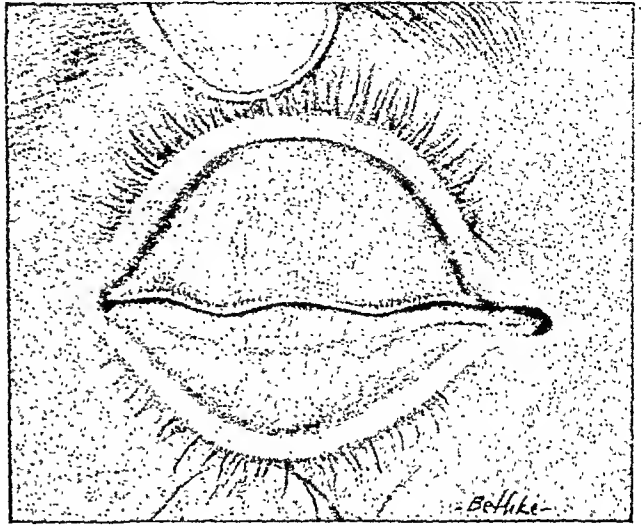


Fig. 2 (Reese). The same case as shown in Figure 1 after $2\frac{1}{2}$ years. There is an increase in the pigmentation at each extremity of the tarsus, particularly on the temporal side. The pigmentation has also extended horizontally as a narrow line along the upper border of the tarsus fading out in the central portion. In addition, there is a mottled, deep-seated, bluish-black pigmentation faintly seen under the conjunctiva of the lower lid.

In an attempt to determine the nature of this lesion, consideration was given to various types of pigmentation of the conjunctiva. Congenital melanosis or acquired precancerous melanosis would not be sym-

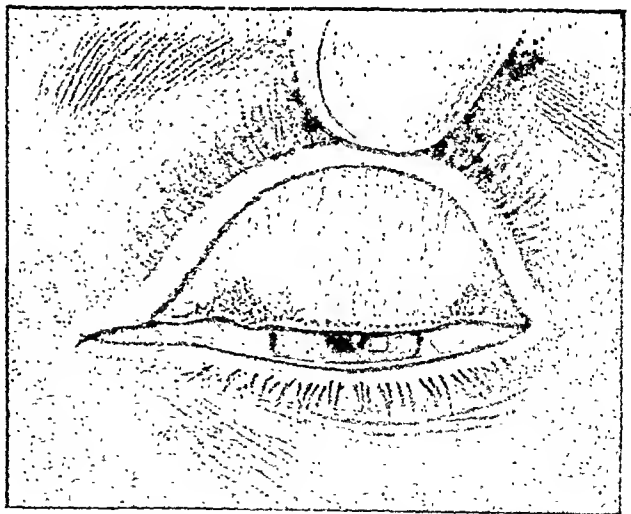


Fig. 3 (Reese). This shows the characteristics of the lesion in the most marked case encountered. The biopsy material was taken from the temporal extremity of the tarsus.



Fig. 4 (Reese). A hematoxylin and eosin stain of biopsy material from the case shown in Figure 3. In the follicles composed of lymphocytic and plasma cells and in the stroma under the follicles, there are accumulations of black-pigment granules in or around stroma cells or free in the tissue.

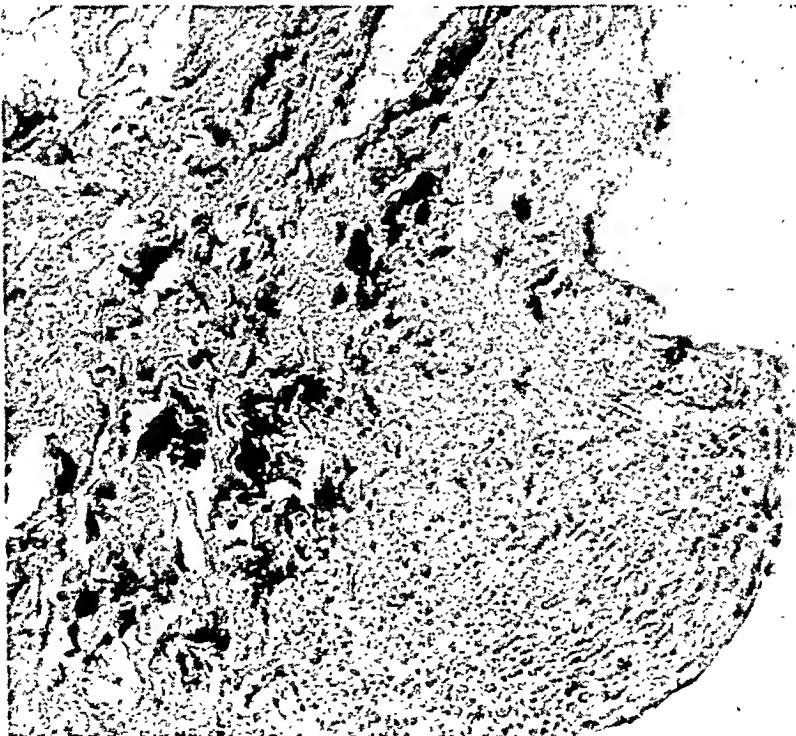


Fig. 5 (Reese). A bleached section of the biopsy material showing the pigment unaffected.

metrical and bilateral and, furthermore, the fact that the pigment is not melanin is indicated by the histologic sections which show, among other things, its failure to bleach. It is not hematogenous pigment because the Turnbull stain showed the absence of iron, and there is no known source of extravasated blood or hemolyzed blood from some systemic condition. Ectogenous or endogenous ochronosis cannot be seriously considered because the location of the pigmentation is not at an exposed site; there is no history of contact with any of the phenol group, no hereditary history, and no alkaptonuria. The condition is not argyrosis because there is no history of local use or ingestion of silver. Furthermore, the location and appearance are not consistent with argyrosis, and the sections rule it out. There is no history to support the occurrence of pigmentation from the long use of adrenalin (I have seen two such cases and they showed jet-black punctate deposits under the palpebral conjunctiva of the lower lid). In the cases reported here, there is no evidence of Addison's disease, no history of exposure to or the use of arsenic, gold, iron, aniline products, indelible substances, or colored inks.

All of the patients were women, five of whom admitted the constant use of mascara and one of whom denied its use so vehemently as to become suspect. One was on the stage and used a great deal of make-up. Off the stage she used, in addition to mascara, eye shadow on the skin of the upper lid. On the stage a process called "beading" was included in her make-up. This consisted of putting a heated black wax on the lashes. She stated that this invariably got in her eyes.

According to the best references I could obtain, mascara is composed of the following:

	Percent
Glyceryl monostearate	10

Triethanolamine	3
Stearic acid	15
Petrolatum	20
Gelatin	2
Water	17
Beeswax	25
Prepared lamp black	8

The appearance and staining reactions of the pigment in the biopsy sections are consistent with its being lamp black. However, there is some evidence that the pigment did not exist as such in the mascara but was precipitated in the tissue. This evidence is the lack of pigment in or adjacent to the epithelium, its location well under the epithelium and sometimes quite deep in the stroma, its close relation to the stroma cells and the tissue interstices, and the absence of a foreign-body type of reaction. If the pigmentation discussed here occurs as the result of precipitation in the tissue, it would be comparable in this respect to the pigmentation from silver which, however, has a predilection for the elastic fibers.

If mascara is the source of the pigmentation, then there must be some individual contributing factor, because everyone who uses mascara does not develop a pigmentation. Only two of the patients considered themselves allergic. The constant presence of follicles is consistent with an allergic reaction but eosinophiles are absent. The use of no one brand of mascara was common to all the patients.

It is concluded that the pigmentation of the palpebral conjunctiva described here results from the use of mascara or allied pigment-bearing cosmetics but that there is some factor peculiar to the individual determining its occurrence.

As women using mascara would, no doubt, consider this pigmentation and its possible attending mild symptoms a cheap price to pay for allure and glamour, the treatment, which is to stop the use of mascara, is probably of no avail

ACUTE REVERSIBLE CATARACT IN CHICKEN DUE TO VARIOUS NITROCOMPOUNDS*

WILHELM BUSCHKE, M.D.[†]

New York

Since the early clinical reports 12 years ago by Horner, Boardman, Cogan, and others on cataracts after prolonged intake of dinitrophenol, an extensive clinical literature on this cataract has accumulated. Horner reviewed this literature in 1942.¹ An identical type of cataract was described due to intake of dinitrocresol which had been used in Scandinavia for weight reduction.²

According to Horner, only 0.86 percent of all individuals who have ingested dinitrophenol are afflicted with cataract, and no correlation to the amount of drug taken, nor to the duration of time during which it had been taken, nor to the age of the patient could be established. In view of the low incidence, it is of interest that this cataract has been described in successive generations of a family,³ and that some years ago dinitrophenol cataract was seen in the Wilmer Institute in a pair of identical twins. This suggests that a genetic predisposition plays an important role in the susceptibility to this cataract. This notion is strengthened by the fact that in spite of extensive ex-

periments of long duration by many authors it has been found impossible to produce dinitrophenol cataract experimentally in various other species; namely in rats, rabbits, guinea pigs, and dogs, although Bettman⁵ observed D.N.P. cataract in a special strain of mice. In contrast to the unsuccessful experiments in various other species, Robbins was able to produce experimental D.N.P. cataract in baby ducks and baby chicks with close to 100-percent results, although the upper age limit for the susceptibility was rather low.⁴ These observations have been essentially confirmed and somewhat extended by Bettman,⁵ while Dietrich and Beutner⁶ failed to produce cataracts with two mononitrophenols in chicks with Robbins' procedure.

Recently, Petty and Martin¹² observed some slowing of the onset of D.N.P. cataract by thiouracil, but they could not lower the incidence of its occurrence.

In addition to the obvious genetic predisposition, the complexity of the pathogenetic problem is illustrated by the facts (1) that the D.N.P. cataract in birds develops acutely in contrast to the chronic cataract in human beings, and (2) that it is, according to Bettman, and to my own observations, reversible even in spite of the continued intake of the drug. It appeared to be desirable to pursue the experiments on chicks more systematically because the regular susceptibility of this species would promise to provide some foothold on the pathogenesis of this cataract.

The following experiments were designed to standardize the conditions for the experimental production of the D.N.P. cataract, to test related com-

*From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital. This work was supported in part by the John and Mary R. Markle Foundation. Read at the 16th scientific meeting of the Association for Research in Ophthalmology, Inc., Atlantic City, June 10, 1947.

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I am indebted for the supply of some of the compounds used in this study to Dr. L. B. Hellerman, department of biochemistry, Johns Hopkins Medical School; Dr. D. E. Kvalnes, E. I. Du Pont Company, Wilmington, Delaware; and Dr. Guggenheim, Hoffman-LaRoche Company, Basel, Switzerland.

The drawings of Figures 1, 1a, 2, and 2a were made by Mrs. A. S. Burgess.

pounds for their cataract-producing capacity, and to correlate the occurrence of the cataract with other biologic and metabolic effects of these compounds. While the first two of these approaches yielded interesting observations, the latter one—that is, the correlation with other effects of the drug—is so far in a quite fragmentary state.

Robbins produced the cataract by mixing dinitrophenol with the diet fed to the animals. My preliminary experiments with varying concentrations of 2, 4-D.N.P. in the diet showed that the occurrence of cataract was dependent on the amount of D.N.P. ingested over a given period of time, and that the threshold concentration of D.N.P. in the diet of baby chicks was 0.1 percent.

The standard procedure then adopted was the administration of the compound as a 0.2- to 0.4-percent solution in peanut oil (with a few compounds in water) in a single dose by stomach tube or intramuscularly. With this procedure, cataracts developed promptly after 1 to 1½ hours in any number of different strains I have tested. The threshold dose is 20 micrograms (1/50 of a mg.) per gm. bodyweight. Cataracts developed promptly also in adult chickens with this procedure, and the failure to produce cataracts in older animals with the ordinary feeding technique in the diet may be due to the fact that older animals have a relatively smaller food intake, in relation to their bodyweight, than young ones.

The first opacities are seen around the suture lines at the anterior pole of the lens (fig. 1) but, after a few hours, the anterior and posterior cortex become diffusely opaque. The suture lines at the anterior pole often gape in an early stage. Under the dissecting microscope, the lens fibers surrounding the anterior pole have a brittle appearance, and innumerable minute structures with the appearance

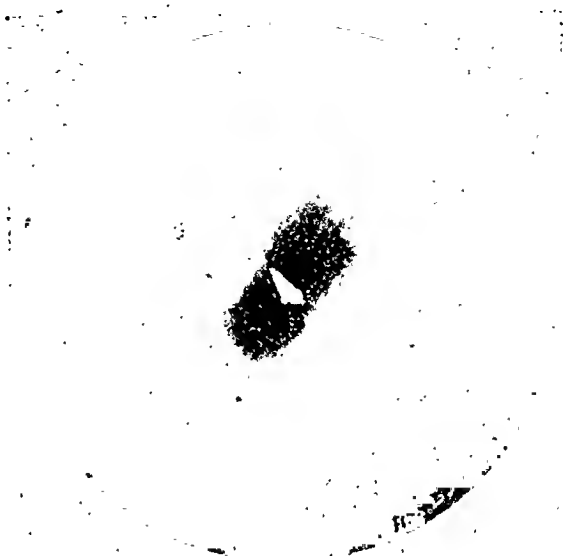


Fig. 1 (Buschke). Beginning dinitrophenol cataract in chick, with gaping suture lines at anterior pole.



Fig. 1a (Buschke). Appearance of lens under dissecting microscope in early dinitrophenol cataract of chick.

of tiny vacuoles are seen. I could not decide whether these vacuoles were inside or surrounding the individual lens fibers (fig. 1a). With doses with which the animals survive, the lenses become spontaneously clear again after about 24 hours. With the disappearance of the anterior opacities the posterior opacities become more clearly visible (fig. 2).

In feeding experiments, the lenses become clear again with suitable doses after a few days even in spite of continued presence of the drug in the diet. However, systematic experiments have not as yet been done with repeated chronic application of the drug by injection and, therefore, it cannot be excluded, at present, that the spontaneous recovery in continued feeding experiments may be

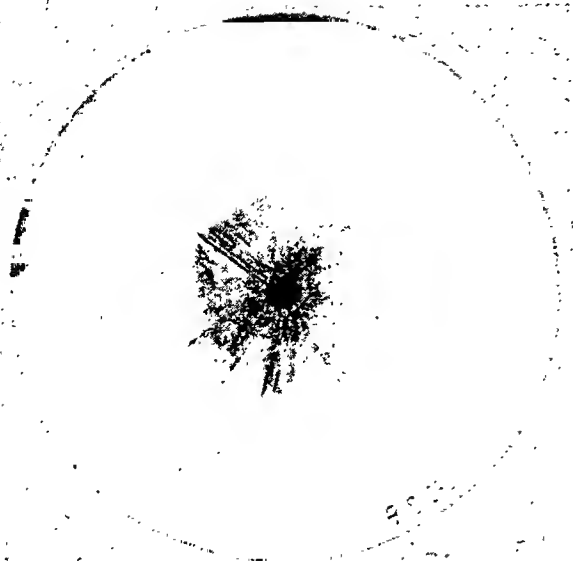


Fig. 2 (Buschke). Posterior polar lens opacities seen during recovery period from dinitrophenol poisoning in chicken. (Composite drawing.)

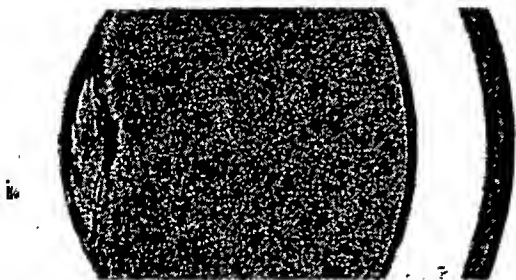


Fig. 2a. (Buschke). Appearance of lens opacities, in the same stage as shown in Figure 2, as seen in the narrow beam of the slitlamp.

due to a diminished food, and thus drug, intake.

Attempts to produce the D.N.P. cataract in vitro had, similar to Bettman, essentially negative results. Whole eyes or removed lenses were kept in varying concentrations of D.N.P.—sodium salt in Tyrode's solution or beef aqueous, or the solutions were injected into the vitreous of the enucleated eye after removal of some intraocular fluid. In none of these experiments were the opacities which developed of the same degree as those in living animals, and, in fact, they were

not significantly different from the controls. Eyes were also removed 40 minutes after systemic, in vivo, poisoning of chicks with D.N.P. and stored in a moist chamber at body temperature; some opacities developed in the lenses of the enucleated eyes, but even here they seemed to be less extensive than in vivo. It appears, therefore, that some factor other than or in addition to D.N.P. is required for the development of the cataract, and that this additional factor is manufactured elsewhere in the body. This aspect requires further experimental study.

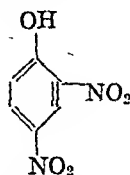
In order to test the possibility that the cataract may be due to dehydration, distilled water was instilled at frequent intervals during the period of poisoning; this, however, did not inhibit the development of cataract. If lenses after development of the opacities were removed and immersed in Ringer's solution of varying dilutions, the opacities cleared partially within a few hours, but this clearing process was not more marked in the lesser concentrations than it was in the higher salt concentrations. There is, then, no evidence that the cataract is produced by dehydration due to increased tonicity of the surrounding fluids.

With the peroral or intramuscular technique of administration, 37 compounds chemically related to dinitrophenol were tested in varying amounts for their cataract-producing capacity. With many of these compounds, the rectal temperatures of the chicks were recorded for several hours after poisoning, and the oxygen consumption of the animals was recorded in a respiration chamber after Tainter and Rytand.⁷ The respiration chambers were kindly loaned by Dr. E. K. Marshall, Jr., department of pharmacology of the Johns Hopkins Medical School. The results are summarized in the following tables.

The following groups of compounds were tested and classified according to the modification of radicals attached to the benzene ring.

TABLE 1

GROUPS OF COMPOUNDS TESTED AND CLASSIFIED



2,4-DINITROPHENOL

I

IMPORTANCE OF PRESENCE, NUMBER AND POSITION OF *NITRO-GROUPS*:

Other DN-Phenols
Mono-Nitrophenols
Halogen-Phenols
Carboxy-Phenols (Salicylic Acids)
Aminophenol

II

IMPORTANCE OF PRESENCE AND NUMBER OF FREE *PHENOLIC HYDROXYL-GROUPS*:

Benzenes and DN-Benzenes
DN-Chlorobenzene
DN-Toluene
DN-Anisole
DN-Phenetole

III

INTRODUCTION OF SECOND *RING-SYSTEM*:

DN-Naphthol
DN-6-cyclo-hexyl-phenol

IV

INTRODUCTION OF *ADDITIONAL NITRO-GROUP OR HALOGENS*:

Picric Acid
2,4-DN-Chlorophenols

V

IMPORTANCE OF *METHYL- AND OTHER ALKYL-GROUPS*:

DN-Cresol
DN-Thymol
DN-tertiary butyl-phenol
DN-Mesitylene

VI

OTHER *CYCLIC COMPOUNDS*:

Naphthalene
Nitro-Cinnamic Acid

SUMMARY OF TABLE 2

Table 2 illustrates that any omission or substitution of any of the two nitro-groups by either halogens or carboxyl-groups abolishes cataract-producing activity with the exception of 2,6-dibromo, 4-nitrophenol; that is, of a compound where one nitro-group in paraposition is maintained in addition to two halogens in ortho-position to the phenolic hydroxyl-group. It is of interest that 2,6-dinitro-4-chlorophenol—that is, a compound with two nitro-groups in ortho-position and one halogen in para-position—seems to be less active, although the higher general toxicity makes it difficult to draw very definite conclusions.

Shifting of the second nitro-group from para-position into ortho-position in 2,6-dinitrophenol reduces activity considerably.

It is obvious that the optimal situation is the presence of two nitro-groups, one in ortho-, the other in para-position, and that the presence of one nitro-group in para-position is of greater importance than the one in ortho-position.

SUMMARY OF TABLE 3

Omission or substitution of the phenolic hydroxyl-group by a halogen or methyl-group abolishes cataract-producing activity. The presence of the phenolic hydroxyl group is an absolute necessity. The activity of the anisole- and phenetole-compounds is most likely to be explained by an hydrolysis of the ester with liberation of the free phenol in the body; the somewhat delayed onset of cataract after administration of these compounds is in agreement with this interpretation.

SUMMARY OF TABLES 4 AND 5

Introduction of a second ring system into the molecule interferes with cataract-producing activity.

TABLE 2
IMPORTANCE OF PRESENCE, NUMBER AND POSITION OF NITRO-GROUPS
(First Part)

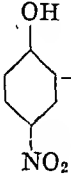
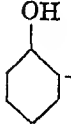
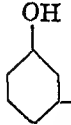

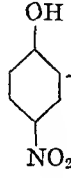

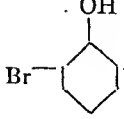
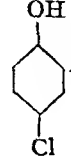
Compound	Amount millimol/kg	Application po:peroral im:i.muscul. o:in oil	Cataract in vivo	Onset of cataract hrs.	Death	Time of death hrs.	Cataract after death	Temper.—Drop more than 2° F.	Increase of O ₂ — Uptake
 2,4-dinitro-phenol	0.03	po.o.	—	—	—			+	
	0.06	po.o.	+	3½	—			+	
	0.11	po.o.	+	2	—			+	
	0.11	im.o.	+	2	—			+	
	0.22	po.o.	+	1	+	24		+	
	0.43	po.o.	+	1	+	3			
	0.43	im.o.			+	1	+		+
 o-nitrophenol	0.71	po.o.	—	—	—				
 m-nitrophenol	1.00	po.o.	—	—	—				
 p-nitrophenol	0.86	po.o.	—	—	—				
	2.88	po.o.	—	—	—				
	5.76	po.o.	—	—	—				
	6.47	po.o.	—	—	+	1	+		
 4-nitro-2-chlorophenol	0.81	po.o.	—	—	—				
 2,4-dibromo-phenol	0.32	po.o.	—	—	—				
	0.56	po.o.	—	—	—				
 2,6-dibromo-phenol	0.56	po.o.	—	—	—				
 2,4-dichloro-phenol	0.86	po.o.	—	—	—				

TABLE 2
IMPORTANCE OF PRESENCE, NUMBER AND POSITION OF NITRO-GROUPS
(Second Part)

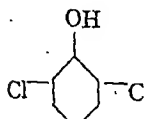
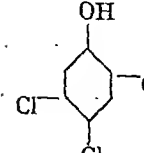
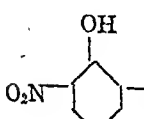
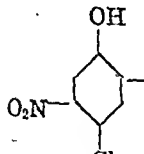
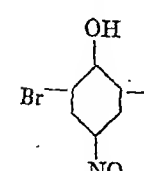
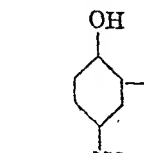
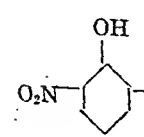
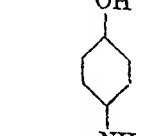
Compound	Amount millimol/kg	Application po:peroral im:intramuscul., o:in oil w:in water	Cataract in vivo	Onset of cataract hrs.	Death	Time of death hrs.	Cataract after death	Temp.—Drop more than 2° F.	Increase of O ₂ — uptake
	2,6-dichloro-phenol 0.74	po.o.	—	—	—				
	2,4,5-tri-chloro-phenol 0.31 0.41 0.31	po.o. po.o. im.o.	— — —	— — —	+ — —	24		—	—
	2,6-dinitro-phenol 0.43	po.o.	±	5	+	5		+	—
	2,6-dinitro-4-chloro-phenol 0.18 0.37 0.55	po.o. po.o. po.o.	— — —	— — —	+ — +	2 1	±? —		
	2,6-dibromo-4-nitro-phenol 0.13 0.27	po.o. po.o.	+ +	3 2	— +	24		+	+
	3-nitro-salicylic acid 0.77	po.o.	—	—	—				
	5-nitro-salicylic acid 0.77	po.o.	—	—	—				
	p-amino-phenol (hydrochlor.) 0.84	po.w.	—	—	—				

TABLE 3
IMPORTANCE OF PRESENCE AND NUMBER OF FREE PHENOLIC HYDROXYL-GROUPS

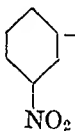
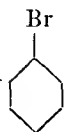
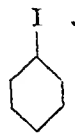
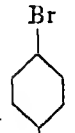
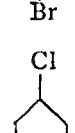
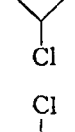
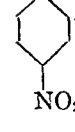

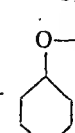
Compound	Amount millimol/kg	Application po:peroral im:im. muscul o:in oil	Cataract in vivo	Onset of cataract hrs.	Death	Time of death hrs.	Cataract after death	Temper.—Drop more than 2° F.	Increase of O ₂ — uptake
 m-dinitrobenzene	0.48	po.o.	—	—	±	24			
 bromobenzene	1.02	po.o.	—	—	+	24			
 iodobenzene	1.18	po.o.	—	—	—				
 p-dibromobenzene	0.42	po.o.	—	—	—				
 p-dichlorobenzene	0.82 0.82	po.o. im.o.	— —	— —	— —				
 2,4-dinitrochloro- benzene	0.59	po.o.	—	—	±	24			
 2,4-dinitrotoluene	0.77	po.o.	—	—	—				
 2,4-dinitroanisole	0.40 0.40	po.o. im.o.	+ +	5 4					
 2,4-dinitrophenetole	0.38 0.38	po.o. im.o.	+ +	2 2	±	5			

TABLE 4
INTRODUCTION OF A SECOND RING-SYSTEM

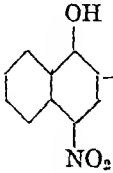
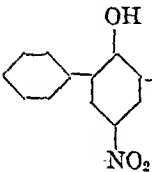
Compound	Amount millimol/kg	Application po:peroral im:i. muscul. o:in oil	Cataract in vivo	Onset of cataract hrs.	Death	Time of death hrs.	Cataract after death	Temper.—Drop more than 2° F.	Increase of O ₂ — uptake
 2,4-dinitro- naphthol	0.34	po.o.	—	—	+	4	—	+	
 2,4-dinitro, 6-cyclohexyl- phenol	0.22 0.22 0.30	po.o. im.o. po.o.	— — —	— — —	+ + —	1 20 min.	— ±	 +	

TABLE 5
INTRODUCTION OF ADDITIONAL NITRO-GROUP OR HALOGENS

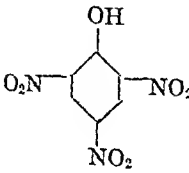
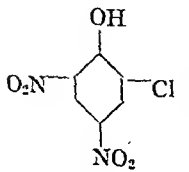
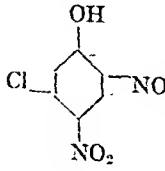
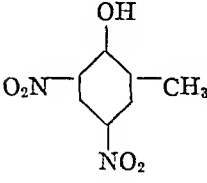
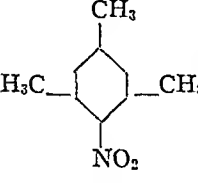
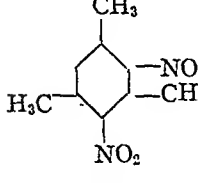
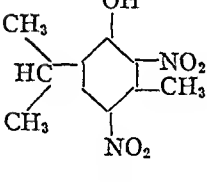
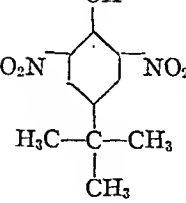
Compound	Amount millimol/kg	Application po:peroral im:i. muscul., o:in oil w:in water	Cataract in vivo	Onset of cataract hrs.	Death	Time of death hrs.	Cataract after death	Temper.—Drop more than 2° F.	Increase of O ₂ — uptake
 picrate (sodium)	1.75 (acid) 1.96 (salt) 3.54 (salt)	po.o. po.w. po.o.	— — —	— — —	+ — +	2½ 1	+ —		
 2-chloro- 4,6-dinitro- phenol	0.28	po.o.	+	4				+	—
 2,4-dinitro-, 5-chloro- phenol	ab. 0.37 0.73	po.w. po.& im.w.	— + —	— — (45 min.)	— — —			+	+

TABLE 6
IMPORTANCE OF METHYL—AND OTHER ALKYL—GROUPS

Compound	Amount millimol/kg	Application po:peroral o:in oil	Cataract in vivo	Onset of cataract hrs.	Death	Time of death hrs.	Cataract after death	Temper.—Drop more than 2° F.	Increase of O ₂ — uptake
	3,5-dinitro- o-cresol	0.0125	po.o.	+	4-5	—		+	
		0.02	po.o.	++	2	—			
	(4,6-dinitro- o-cresol)	0.025	po.o.	++	2	+	11½	+	
		0.10	po.o.	+	1				
		0.30	po.o.			+	1	+	
	nitro- mesitylene	0.85	po.o.	—	—	—			
	2,4-dinitro- mesitylene	0.67	po.o.	—	—	—			
	2,4-dinitro- thymol	0.25	po.o.	—	—	+	3	+	
	2,6-dinitro- 4-tertiary butyl-phenol	0.33	po.o.	—	—	deep anes- thesia		+	



Introduction of a third nitro-group in ortho-position seems to interfere with cataract-producing activity, although the experiments with picrate may not be quite conclusive in view of the general toxicity. Introduction of a halogen-group in addition to the two nitro-groups does not

abolish activity, but reduces it to some degree.

SUMMARY OF TABLE 6.

Introduction of one methyl-group in ortho-position increases activity about five-fold. However, introduction of addi-

TABLE 7
OTHER CYCLIC COMPOUNDS

Compound	Amount millimol/kg	Application po:peroral o:in oil	Cataract in vivo	Onset of cataract hrs.	Death	Time of death hrs.	Cataract after death	Temper.—Drop more than 2° F.	Increase of O ₂ — uptake
 Naphthalene	61.54	po.o.	—	—	+	4			
 $\text{CH}=\text{CH}-\text{COOH}$ p-nitro- cinnamic acid	1.04	po.o.	—	—	—				

tional methyl-groups and more complex alkyl-side-chains interferes with the cataract-producing activity.

SUMMARY OF TABLES 7 AND 8

The absence of any cataract-producing activity of naphthalene in acute experiments in the chick is of interest and will

be referred to again in the discussion on the specificity of the effects of dinitrophenol.

Table 8 summarizes the approximate relative cataract-producing activities of various compounds of the previously discussed groups.

DISCUSSION

1. SPECIFICITY

The absence of any cataract-producing effect of naphthalene in very high concentrations in these acute experiments and the loss of activity with even much slighter modifications in the molecule indicates that the cataract due to D.N.P. is a very specific phenomenon. Therefore, it appears very doubtful that the pathogenesis of cataracts, both clinical and experimental, reported in poisoning with various cyclic compounds has much in common with the mechanisms primarily concerned in D.N.P. cataract.

2. RELATION TO OTHER BIOLOGIC EFFECTS

Various nitro- and other substituted phenols, notably halogen-phenols, have

TABLE 8
COMPARISON OF CATARACT PRODUCING ACTIVITIES
OF VARIOUS NITRO-COMPOUNDS
(2,4-Dinitrophenol=1)

4,6-DN-Cresol	4.8
2,4-DN-Phenol	1.0
2,4-DN-Anisole	0.5
2,4-DN-Phenetole	0.5
2,6-Dibromo-4-Nitro-Phenol	0.5
2-Chloro-4,6-DN-Phenol	0.22
2,4-DN-5-Chloro-Phenol	<0.16>0.08
2,6-DN-Phenol	0.14
m-DN-Benzene Mono-Nitro-Phenols 2-Chloro-4-Nitro-Phenol 2,4-DN-Naphthol 2,4-DN-Thymol Nitro-Salicylic Acids 2,4-DN-Chlorobenzene 2,4-DN-Toluene 2,4-DN-Mesitylene 2,4-Dichloro-Phenol	<0.125 or 0

been extensively studied by Krah1 and Clowes ^{8, 8a} in their effect on mitosis and metabolism in the eggs of some marine animals. The interference of halogen substitution and ring-system substitutions with cataract-producing activity is in strong contrast to these effects on marine eggs where both mitosis and respiration are similarly affected by nitro-phenols and by halogen- and some double-ring-phenols. This lack of correlation again underlines the high specificity we have to assume for the mechanisms involved in D.N.P. cataract.

The drop of body temperature found in chicks which had been poisoned with cataract-producing nitro-phenols has also been found with compounds which did not produce cataract and may be ascribed to other unrelated toxic effects of these compounds. Moreover, adult chickens did not show a drop in temperature, and it can, thus, be excluded that the cataract is a cold-cataract or otherwise closely or directly related to the body temperature changes.

A fairly good correlation was found between the cataract-producing activity and the metabolic effects on the whole animal of various compounds as tested by the basal metabolism. With at least two compounds, 2,6-D.N.P. and 2-chloro, 4,6-D.N.P., no increased metabolic rate was found in chicks in spite of the production of cataracts. It has to be admitted, however, that with these compounds the onset of cataract was delayed and that the difference as compared with other compounds may turn out to be only a question of dosage, if this could be tested without entering the ranges of general toxicity. At any rate, these two exceptions are not sufficient to justify the conclusion that the increased oxygen uptake does not have some relation to the cataract. It is quite conceivable that an increased oxygen uptake of the tissue is not

the cause of the cataract, but rather a corollary, secondary effect of some primary metabolic disturbance and that a further set of unknown factors determines whether the oxygen uptake is increased in the tissue with no production of cataract, or cataract is produced without an increase in oxygen uptake, or whether both effects take place. It is of some interest in this connection that Field II, Tainter, Martin, and Belding⁹ found an increased respiration in rabbits' lenses with certain concentrations of D.N.P., while it is known that this species is not susceptible to D.N.P. cataract.

The notion that the increased respiration is not the cause and is only indirectly connected with the cataract mechanism can easily be reconciled with a recent viewpoint held by biochemists on the mechanism of action of D.N.P. in tissue metabolism. It has been found that D.N.P. interferes vigorously with the phosphorylative processes in microorganisms;¹⁰ the viewpoint based on these experiments is that increased respiration is only secondary to these disturbances in phosphorylative mechanisms and that, with this increased oxidation, energy is wasted and sidetracked from storage and utilization in high-energy phosphates which are connected with some specific tissue functions.¹¹ Experiments designed to test phosphorylative mechanisms in chick lenses with these various compounds and to correlate them to their respective cataract-producing activities would seem to be a promising experimental approach.

SUMMARY

1. Acute reversible cataracts can be produced in chicks and chickens of any age within 1 to 1½ hours after application by stomach tube or by intramuscular injection of small amounts of 2,4-dinitrophenol in peanut oil. The threshold

dose is about 0.06 millimol per kg. body-weight.

2. In ordinary feeding experiments spontaneous recovery takes place; that is, the lenses clear again, in spite of continued presence of the drug in the diet.

3. Experiments to produce D.N.P. cataract in vitro have failed.

4. Thirty-seven chemically more or less closely related compounds have been tested for their cataract-producing activities. Of these, only eight produced cataracts in vivo within from 1 to 5 hours after administration, 3,5-dinitro-o-cresol (4,6-dinitro-o-cresol in another nomenclature) being the most efficient one with an activity about five fold that of D.N.P. itself. The most outstanding properties favoring cataract-producing activity are

the presence of a phenolic hydroxyl-group, and of at least one nitro-group, preferably in para-position, while the addition of a second ring abolishes activity.

5. The cataract is not a cold-cataract nor an osmotic cataract due to dehydration.

6. A fairly close, but not absolute, correlation exists between the cataract-producing properties of these compounds and their ability to raise the basal metabolism of the animal. The possibility is discussed that an increased tissue respiration is only a corollary effect, and that the cataract is more directly related to other metabolic effects of these nitro-compounds and not caused by the increased respiration.

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DISCUSSION

DR. CLYDE A. CLAPP (Baltimore, Maryland): I should like to ask Dr. Buschke if he considers a reversible opacity in the lens as a true cataract or simply an opacity in the lens?

DR. WILHELM BUSCHKE (New York): Well, I think that depends on the definition of the word "cataract." From a patho-physiologic standpoint, I think the essential thing is the change which takes place in the optical properties of the lens. As long as we don't know more about the pathogenesis of cataracts we had best stick to a definition based on this criterion, but for our purpose it doesn't matter much whether we call it "cataract" or "lens opacity."

Now, the interesting point in this type of lens opacity is that in various species it behaves differently. In human beings, it is not reversible; while in the animal it is. This raises the question whether this experimental cataract can be considered as analogous to the clinical cataract produced with this compound in human beings. I believe, however, it would be very far-fetched to assume that lens opacities produced by compounds of this type, both clinically and in experimental animals, would have nothing to do with each other, even if they follow a different course in different species.

DR. CLAPP: I should also like to ask Dr. Buschke what the difference is between a transparent protein and one which is opaque—for instance, what is the difference between clear proteins and precipitated proteins? Is it a chemical change or is it a physical change, with the rearrangement of the molecules or the atoms.

DR. VERHOEFF (Boston, Massachusetts): Does that have anything to do with this particular paper?

DR. CLAPP: I should think that any change in opacity is part of any change in the lens itself.

DR. VERHOEFF: Well, if Dr. Buschke would like to answer it, all right.

DR. BUSCHKE: I should be very happy if I could answer this question in relation to the lens because then, I think, the cataract problem would be solved; but I do not claim to have solved this problem.

DR. VERHOEFF: Most of us here are clinicians and I think we always try to apply everything clinically as far as possible. Perhaps that is not the correct attitude, but we all have it. I should like Dr. Buschke to tell us whether he has attempted to correlate his experimental work with the dinitrophenol cataract of human beings; for instance, does he think that every human subject would develop this cataract if the dose were sufficient? Or are certain individuals susceptible and others not? I don't know whether or not Dr. Buschke's experiments could be expected to cover that.

DR. BUSCHKE (closing): I think this is a very interesting and intriguing question. Of course, my experiments do not provide any direct answer to this question. However, according to Horner only a very small percentage of human beings, who have ingested the drug, do get cataract, and the occurrence of the cataract in human beings is correlated neither to the amount of drug nor to the period over which it has been taken. It appears, both on the basis of clinical observations and by virtue of the fact that—in contrast to human beings—these compounds produce lens opacities with about 100 percent regularity in some other species, that a genetic predisposition plays an important role in the susceptibility to this cataract.

VIRUS STUDIES IN LYMPHOMATOID DISEASES OF THE OCULAR ADNEXA

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INTRODUCTION

The possibility of viruses causing neoplasms is not a new concept. Borrel¹ suggested that cancer was the result of virus infections. Since then investigators in France and elsewhere have found neoplasms containing viruses. The hypothesis of the virus etiology of cancer has had a rather stormy course, and the majority of cancer-research groups refuse to consider it as a possibility. Duran-Reynalds and Shrigley² have compiled a large bibliography on the virus approach to the cancer problem.

Several general and ophthalmic pathologists have considered the possibility of some inflammatory diseases becoming neoplastic; this has been particularly true in the syndrome known as pseudotumor of the orbit. Biopsies of this peculiar orbital disease histologically show chronic inflammatory tissue. Similarly there has always been considerable confusion among these inflammatory tumors, lymphomas, and malignant exophthalmos associated with hyperthyroidism.

Birch-Hirschfeld³ classified most of the types of orbital tumors, particularly pseudotumors. He classified the pseudotumors of the orbit as follows: (a) exophthalmos which regresses spontaneously, (b) exophthalmos associated with a definite orbital tumor that is relieved by removal of the tumor, and (c) exophthalmos which persists. Occasionally these

pseudotumors of the orbit continue to extend and eventually a diagnosis of malignant lymphoma is made; although numerous associated lymph nodes may develop over the rest of the body, most of these individuals do not follow the usual course of a malignant lymphoma.

The present investigation was undertaken in order to determine the etiology of this particular type of malignant exophthalmos.

CASE REPORT

HISTORY

J. W. B. was first examined by numerous physicians in Glasgow, Scotland, in August, 1938, because of edema of the lids and conjunctivitis. Behind the upper lid was a palpable mass, and there was some exophthalmos of both eyes. The upward rotation of the right eye was limited; diplopia was present in this field and at times in the primary position. He gave a history that the swelling in the upper lids began insidiously in May, 1937. At that time it was thought that the swelling was allergic.

In October, 1938, two portions of the growth were excised by Professor Ballantyne. Sections of the tumor suggested a probable giant follicular lymphoma. X-ray studies of the chest was normal, and the vision at that time was 6/3 in each eye. The patient was given a course of X-ray therapy during which time his exophthalmos increased so that approximately six months later it measured 25 mm. in each eye.

VISUAL EXAMINATIONS

In May, 1939, he developed marked chemosis of the bulbar conjunctiva. The

* From the College of Physicians and Surgeons, Columbia University. Read at the 16th scientific meeting of the Association for Research in Ophthalmology, Inc., Atlantic City, June 10, 1947. This work was supported in part by a grant from the Snyder Ophthalmic Foundation.

vision was reduced to 6/9 in each eye. The differential blood count showed a marked eosinophilia, there being 14-percent eosinophiles with 61-percent neutrophiles; the lymphocytes were only 18 percent. A biopsy of the conjunctival tissue was performed, and the diagnosis of possible lymphocytoma was made. There were large numbers of eosinophiles present in the conjunctival tissue. The patient was

in the left eye. The exophthalmos was still marked. In November, 1942, a right frontal osteoplastic craniotomy was performed and the roof of the orbit was removed. Considerable orbital tissue was excised. Microscopic examination of the tissue showed a tumor of the myeloma group, probably plasmocytoma. However, the cells varied in type, and the muscles and connective tissue contained many eo-



Fig. 1 (Braley and Alexander). These pictures of J. W. B. show the progress of the disease. The first was taken in September, 1938; the second in May, 1940; and the third in September, 1945.

given another course of X-ray therapy but with little improvement; the exophthalmos continued and by June, 1939, it had increased so that the apex of the cornea measured 33 mm. in each eye from the lateral rim of the orbit.

He was again seen in March, 1940, and the eyes were more divergent; the interpupillary distance measured 71 mm.; the vision was reduced to 6/13 in the right eye and 6/36 in the left eye. The exophthalmometer reading was 31 mm. in the right eye and 36 mm. in the left eye. He was given repeated X-ray treatments, and the condition seemed to relapse so that by January 1, 1942, his vision had improved to 6/6 in each eye and the exophthalmos had decreased. However, by February, 1942, there was loss of vision, and the patient had many areas of degeneration in the fundi; it was noted that he also was developing cataracts.

By September, 1942, the vision was reduced to 3/60 in the right eye and 6/24

sinophiles and plasma cells. He was seen again a month later with marked ulceration of both corneas. The exophthalmos seemed to be greater than before the operation. By January, 1943, the eosinophilia had increased to 44 percent and the neutrophilic polys were 47 percent.

The patient was not seen for the next 2½ years but the proptosis continued and he developed bilateral cataracts. He was next seen in July, 1946, by Dr. A. B. Reese, whose examination revealed an extreme exophthalmos of both eyes which could not be measured with the exophthalmometer. Both eyes were fixed, the right eye turning down and out. There was edema and protusion of the bulbar conjunctiva of the lower lids with hyperkeratosis. In both orbits, firm nodular tissue was palpable through both the upper and lower lids. There were bilateral cataracts, and the right cornea showed extensive vascularization below, apparently due to exposure. There were tremendous tortu-

ous blood vessels in the lower fornix of the right eye. There were large lymph nodes in both sides of the neck extending into the cervical region.

It is interesting to note that on only three occasions was there any remission in the exophthalmos. This was during and following a severe bronchial pneumonia, for a short time after the craniotomy, and after an attack of pleurisy. On each occasion the exophthalmos returned.

PHYSICAL EXAMINATION

The patient's blood pressure was 126/90 mm. Hg; the physical examination except for the head, neck, and eyes was essentially negative. There was an advanced exophthalmos with marked edema of the lids. There were numerous lymph nodes in the submaxillary region and many lymph nodes in the anterior and posterior cervical triangle. The parotids also appeared to be swollen, but there was no preauricular lymph node palpable.

The skin test with tuberculin was slightly positive in 1:100,000 dilution; however, when this test was repeated with 1:10,000 dilution it was entirely negative. The Frei test was negative, the brucella-lyngyn test was positive, and the blood Kline was negative. The blood count showed 11.6 gm. of hemoglobin, 3,850,000 erythrocytes, and 8,400 leukocytes. The sedimentation rate was elevated by 101 mm. in one-half hour and 127 mm. in one hour. There was 45-percent neutrophils, 20-percent eosinophils and 34-percent small and large lymphocytes. The metabolic rate was +15, but this reading was not reliable. There was diffuse clouding in the X-ray pictures of the sinuses. Repeated blood counts showed a definite eosinophilia ranging between 20 percent and 24 percent. X-ray studies of the chest showed definitely enlarged hilar lymph nodes; and the blood agglutination for

brucella was positive up to 1:320. Blood cholesterol was normal and the A/G ratio was 0.2. There were no changes in the long bones or in the joints in the hands. Fasting blood sugar was 83 mg. percent and the blood-sugar curve was normal. The cephalin flocculation was negative. Serum phosphatase was 1.4 Bodansky units. The urea-nitrogen was 16 mg. percent.

A biopsy of the left submaxillary gland and several lymph nodes was done since the patient did not wish to have his orbits reexamined. There was considerable confusion in the diagnosis of the tumor. It was considered a giant follicular lymphoma by the majority of pathologists, but Dr. A. P. Stout thought the tissue inflammatory and not neoplastic.

PATHOLOGY OF CLINICAL DISEASE

A microscopic slide made from the original biopsy of the orbit was available for examination. The section shows an elongated piece of tissue on one side of which a small bit of glandular material is seen. The gland appears to be part of the lacrimal or accessory lacrimal gland. The tissue is composed mostly of dense strands of connective tissue. Interposed between these strands are collections of lymphocytes. The connective tissue is also lightly infiltrated with lymphocytes. The masses of lymphoid tissues are in general similar; they are composed of small and large lymphocytes at the periphery of the masses and, near the center, the lymphocytes become paler and suggest a germinal center. These central areas are composed of pale, blue-staining cells in which an occasional mitotic figure is present. There is also an occasional eosinophilic cell in these masses. The tumor has the general appearance of a giant follicular lymphoma.

The lymph nodes and submaxillary gland from which the animal inoculations

were made were also available for histologic examination. The lymph node has lost most of its normal markings. The sinusoids are densely infiltrated and there are no definite lymph follicles with germinal centers seen. The entire lymph node is generally infiltrated with lymphocytes. The normal architecture of the hilar area is obliterated because of the lymphocytes.

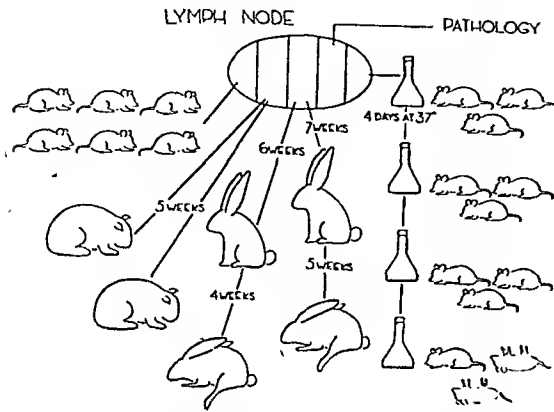


Fig. 2 (Braley and Alexander). Experimental studies showing the marked infiltration with lymphocytes.

Most of these lymphocytes are mature; there are a few cells that simulate lymphoblasts scattered in the lymph node and an occasional plasma cell. There are also a few plasma cytoids and Russell bodies present. Under the oil-emersion lens, most of the larger cells appear to be endothelial cells from the lymph sinusoids, and some of these cells appear to be degenerated. Some of the cells are multinucleated simulating Dorothy-Reed cells. An occasional eosinophile is present. The submaxillary gland is densely infiltrated with lymphocytes so that the glandular tissue is spread apart by the collections of lymphoid elements. It is composed more of lymphoidal tissue than of normal glandular tissue. The lymphoidal tissue here is likewise composed largely of adult lymphocytes. There may be a few more eosinophiles present in the submaxillary gland than in the lymph node. An occasional

plasma cell and a few plasma cytoids are present. Some of the cells which appear to be large lymphocytes show clear spaces in the nucleus which could represent nuclear inclusions, but these are indefinite. Some of the collections of lymphocytes appear to have germinal centers.

METHODS OF STUDY

A large lymph node and several pieces of the submaxillary gland were available for study. The tissue was divided into six parts. One part of each section was studied histologically; some of the tissue was placed in the deep freeze and other material was macerated in balanced salt solution. Two types of tissue culture were inoculated with this material. One type consisted of serum ultrafiltrate, balanced salt solution, and finely-divided embryo mouse brain, similar to the procedure followed by Simms and Sanders⁴ for propagation of lymphogranuloma virus. The other type of tissue culture was similar except that 17-percent sterile horse serum was substituted for the serum ultrafiltrate. This latter type of tissue culture maintained a more normal pH without adjustment with carbon dioxide as is required with serum ultrafiltrate. All of the inoculated tissue cultures were carried at incubator temperature (37°C.).

These tissue cultures were subinoculated at varying intervals of from 4 to 6 days, then inoculated intracerebrally and intraperitoneally into mice. The original tissue cultures were reinoculated into fresh tissue cultures when the mice were inoculated. The inoculated mice were followed for periods of from 4 to 6 weeks before they were discarded. As the tissue cultures increased in number, each series was inoculated intracerebrally and intraperitoneally into mice. After five consecutive passages through tissue cultures, two of the six mice inoculated

showed signs of encephalitis. Their brains were removed and passed in tissue cultures and other mice. Subsequently a potent agent was obtained, and this procedure of inoculation from tissue culture to mice has been carried on for 28 consecutive passages. During this process, the potency of the virus gradually increased so that it was necessary to make serial dilutions of the tissue culture before the test mice could be inoculated. The tissue-culture potency of the virus was raised to 10^{-6} when tested by serial dilutions intracerebrally in mice. The highest potency of the virus obtained in tissue culture was after four days at incubator temperature.

At the same time that the original tissue cultures were inoculated, the glandular tissue was also macerated in balanced salt solution and inoculated intracerebrally into two guinea pigs, two rabbits, and six mice. The first rabbit developed paralysis of the hind legs 22 days after inoculation; the rabbit lost weight and became lethargic. When it was apparent that the rabbit was ill with an encephalitis, it was killed and the brain removed. The entire brain was stored at -50°C . The second rabbit developed similar symptoms 35 days after inoculation; this brain was also removed and stored at -50°C . The rabbit brain was inoculated into tissue culture, intracerebrally and intraperitoneally into six mice, and intracerebrally into other rabbits. After eight days two of the six mice were dead. The first rabbit inoculated developed encephalitis in 10 days and the second in 12 days.

Of the two guinea pigs inoculated from the original material, the first developed symptoms in 23 days and the second in 32 days. They showed signs similar to the rabbit in that they became lethargic and developed slight paralysis of the hind legs. Their brains were removed and inoculated into other guinea pigs. When it was apparent that an agent was present

which would produce an encephalitis in rabbits and guinea pigs, it was decided to inoculate some of the original tissue which had been kept at -50°C . This material was thus inoculated intracerebrally into guinea pigs and although it produced an encephalitis, the incubation period was prolonged to 42 days and 45

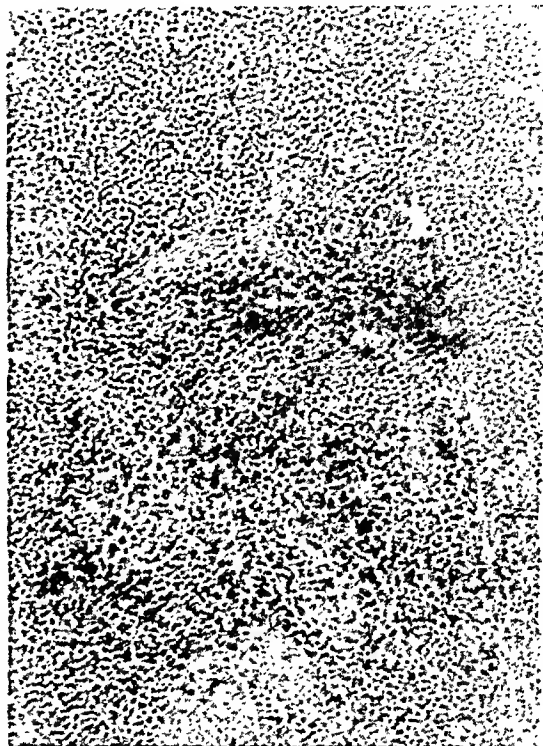


Fig. 3 (Braley and Alexander). Pathology of material for investigation. This shows the marked replacement of the submaxillary gland by lymphocytes.

days, respectively. Since this material appeared to be less virulent than the fresh tissue and was less virulent than the material already obtained in rabbit and mouse brain, it was decided to discontinue these studies.

The second intracerebral guinea-pig inoculation of brain suspension shortened the incubation period. The incubation period was decreased to 14 and 17 days, respectively. The intracerebral transmission into other guinea pigs was continued and again the incubation period was re-

duced; however, one guinea pig was encountered which did not develop symptoms until three months after inoculation. Four consecutive guinea-pig passages were done. Some of the guinea-pig brain was also used to inoculate tissue culture and eventually produced an encephalitis in mice.

Investigation was carried on for the most part with rabbits and mice, utilizing

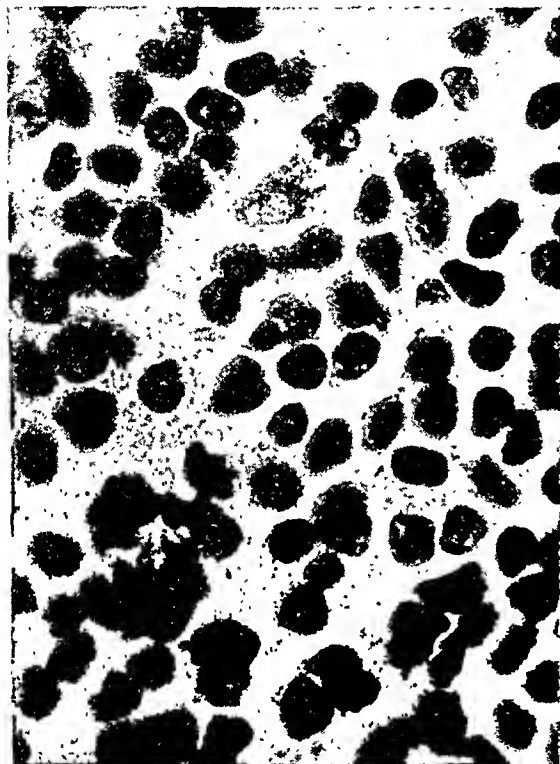


Fig. 4 (Braley and Alexander). Rabbit brain after inoculation with virus shows infiltration with lymphocytes.

tissue culture as an intermediate media to increase the potency of the virus. Six serial passages were carried out in rabbits. All the rabbits were inoculated in a similar manner. The inoculum consisted of a 1:10-dilution of rabbit brain suspension from the previous animal. This material was ground in a ball mill and sufficient balanced salt solution added to make the dilution. Adult rabbits were partially anesthetized with either inhalation ether or nembutal intraperitoneally, and a small

trephine was made through the skull with a short sharp punch. The hair over the skull was shaved prior to the punch, and the entire area painted with iodine. A needle was then inserted into the brain and from 0.2 cc. to 0.5 cc. of this inoculum injected. Although the incubation period of the original material was approximately three weeks, the second rabbit developed symptoms in two weeks. In the third rabbit passage, the incubation period was reduced to one week, and from then on the incubation period did not seem to shorten materially. At each passage some of the rabbit brain was removed for mice- and tissue-culture inoculations. After the second passage in rabbits, 2 of 6 mice died from the direct rabbit-brain inoculation. The tissue culture from this brain was assayed in mice, but its potency was not increased. With each continual passage in rabbits, however, more mice in each series died from the intracerebral inoculation, so that after the fourth passage in rabbits, intracerebral inoculation of the rabbit-brain material produced encephalitis in all of six mice inoculated. After the fourth passage in rabbits, the rabbit-brain material was transmitted intracerebrally to guinea-pig brain and found to be highly potent, the incubation period being reduced to five days. In order to increase the potency of the virus one of the tissue cultures from the fifth passage in rabbits was passed at 5-day intervals. The potency in tissue culture gradually increased so that, when assayed in mice, it killed all of the mice inoculated.

During the early part of the experiments, mice were inoculated both intracerebrally and intraperitoneally. After the fifth passage in rabbit brain, only the intracerebral mouse inoculations were necessary to kill the mice. Because of the expense involved in continual passage in rabbits, we felt that six passages in rabbits were all that were necessary, since we

had the virus not only in rabbits but also in mice, guinea pigs, and tissue culture. By transferring the rabbit brain and mouse brain into tissue culture and back into mice, a very potent virus was obtained. In tissue culture a potency of 10^{-6} was present; in mice this was increased to 10^{-7} . Each of the isolations produced an identical virus.

NEUTRALIZATION TESTS

Gordon,⁵ in 1933, reported a successful transmission of Hodgkin's disease in rabbits. Ground Hodgkin's lymph nodes suspended in saline and injected intracerebrally in rabbits produced an encephalitis from which the rabbits eventually died. The symptoms that were obtained by Gordon were similar to those we found in rabbits. Gordon was unable to transmit the rabbit encephalitis to other rabbits. It was later shown by Turner, Jackson, and Parker⁶ and again by McNaught⁷ that intracerebral inoculation of eosinophiles would produce the same encephalitis in rabbits. Our agent, however, could be transmitted in rabbits, guinea pigs, and tissue culture.

When an agent is present in the body it usually stimulates the formation of antibodies. Therefore, one of the best methods of determining if a virus was obtained from an individual is to search for substances which will neutralize the virus. There are several methods of determining antibodies, but the easiest is to determine their presence in blood serum. It has been shown that after a disease has been present for a varying length of time antibodies are produced. One method of determining their presence is by mixing the virus with the blood serum and then testing for the presence of the virus. In order to arrive at a definite figure, it is necessary to determine the potency of the virus by serial dilutions. These dilutions are usually made in powers of 10. Each

dilution is made so that when 0.02 cc. is injected intracerebrally in mice the actual dosage in mice is 1:10, 1:100, 1:1,000, 1:10,000, and so forth. These dilutions are, therefore, made by logarithmic power. The serial dilutions are then called 10^{-1} , 10^{-2} , 10^{-3} , and so forth, until a dilution is reached where the animals inoculated remain alive after inoculation. If a definite amount of blood serum is added to each of these dilutions so that subsequent dilution is the same as the control to which no serum is added, this can be used as a test to determine the presence or absence of neutralizing antibodies in the serum and the number of neutralizing antibodies when compared to the control. To determine the presence of antibodies each of the dilutions from 10^{-1} to 10^{-6} were injected intracerebrally into three mice, so that for each test 18 mice were used. If the serum completely neutralized the virus, then all the injected mice remained alive while the control mice died. If the serum partially neutralized the virus, then those with the lower dilutions of the serum-virus mixture died while those with the higher dilutions remained alive. This would then indicate a certain degree of antibodies.

Antisera were obtained which would neutralize the viruses of herpes simplex and epidemic keratoconjunctivitis. Normal rabbit serum, normal mouse serum, and several normal patients' sera were also analyzed; blood serum from the patient from whom the tissue had originally been obtained was tested. None of the known sera neutralized the virus; however, the patient's serum neutralized the virus in all dilutions up to 10^{-1} . With normal human sera, all mice were dead in dilutions up to 10^{-6} . Normal rabbit and mouse serum possessed no antibodies to the virus, and only one other patient was found who had any evidence of neutralizing substances in the serum.

Since the amount of serum needed from the patient in conducting neutralization tests was great, we thought it advisable to try to develop an antiserum in animals. Therefore, following a hyperimmunizing procedure, we injected rabbits intraperitoneally and intravenously with small amounts of the virus. Gradually increasing the amount of virus injected gives rise to high antibody titre in rabbits; the rabbit serum can then be used in neutralization tests. After intravenous inoculation with the virus, the rabbits gradually began to lose weight and, although we gave small quantities of the virus, we were unable to demonstrate antibodies in the majority of rabbits. During the intravenous inoculation, blood studies on the rabbits showed a marked increase in the number of lymphocytes. There was only a slight increase in blood count of the rabbits, but the lymphocytic count was as high as 90 percent. This was associated with a slight increase in the lymph nodes throughout the body, particularly those in the peripheral lymphatic system. X-ray studies of the chest and postmortem examination of the mediastinum failed to demonstrate a lymphadenopathy. One rabbit was finally obtained whose serum showed neutralizing antibodies. The antibodies that were present, however, only partially neutralized the virus. When rabbits were inoculated intracerebrally with small amounts of the virus so that the incubation period was prolonged to about three weeks, if they were bled during the first few days of their illness they showed some neutralizing antibodies. Usually these neutralizing antibodies did not develop above 10^{-4} .

In all the neutralization studies we have found only two patients who possess antibodies to the virus. One was the patient from whom we obtained the original material, and the second was a woman who had a peculiar lymphoma in the conjunc-

tiva associated with numerous lymph nodes in the neck. Material was obtained from this patient for study but thus far no definite findings can be presented.

An attempt has been made to obtain serum from other types of lymphatic disease. Blood serum was obtained from four patients suffering from Hodgkin's disease. These patients were in various stages of Hodgkin's disease, and we feel that they should have had neutralizing antibodies if our virus was related to Hodgkin's. None of the patients' sera had any evidence of circulating antibodies to the virus.

FILTRATION EXPERIMENTS

Insufficient data has been collected on filtration to indicate the size of the virus, but enough has been done to show that the virus is small and passes most filters readily. The Seitz absorption-type filter passes the virus in low dilutions. Most of the gradacoll filters we have at hand pass the virus; it appears to pass the gradacoll filter with an average pore size of 93 millimicrons. No high-speed centrifugation experiments have as yet been done.

ATTEMPTS TO REPRODUCE THE CLINICAL DISEASE

When the material is injected intravenously in rabbits, there is a gradual weight loss and in some of the rabbits there is a gradual lymphadenopathy. With the intravenous injection, there appears to be a marked increase in the number of white blood elements. In some instances actually there is a decrease in the white elements from 6,000 to 5,000. The normal white count in a rabbit varies from 3,000 to 7,000. After intravenous inoculation with the virus, the relative number of lymphocytes increases up to 90 percent. There are two possible explanations; either the virus destroys the leukocytic group leaving only the lymphocytic cells,

or the lymphocytes are increased at the expense of the leukocytic cells. The differential counts in rabbits range from 80 to 90-percent lymphocytes, while in normal rabbits the lymphocytic count is rarely over 50 percent. Most of the differential counts in normal rabbits show about 50-percent polymorphonuclear leukocytes and from 40 to 50-percent lymphocytes. In most instances after intravenous inoculation, there is some increase in the size of the lymph nodes. This is particularly pronounced in some of the rabbits; however, this finding seems to be inconsistent, and by intravenous inoculation it is not always possible to produce lymphadenopathy or consistent blood changes.

Single intraperitoneal inoculation into rabbits produces little change except on postmortem examination where there is an increase in the number and size of the lymph nodes. Retrobulbar inoculation of tissue culture containing the virus produces an exophthalmos which persists over a long period of time but gradually seems to decrease. The rabbits given retrobulbar inoculation, however, developed signs of an encephalitis and eventually died. They likewise showed enlargement of the spleen and the liver. The rabbits with the retrobulbar injection developed some neutralizing antibodies to the virus before death. To determine whether the virus produced the exophthalmos and eventual death of the rabbits, one rabbit was inoculated intraorbitally with normal tissue culture. Another rabbit was inoculated with tissue culture in which the virus had been grown for four days. Part of this culture was inoculated into the orbit and another part heated to 60°C. for one hour. This heated virus was also injected into the orbit. Neither of the latter two rabbits showed any symptoms of exophthalmos nor did they develop antibodies to the virus.

PATHOLOGY OF THE EXPERIMENTAL DISEASE

The liver, lungs, spleen, and lymph nodes were available for microscopic examination from rabbits which had been given the virus intravenously. The lymph nodes are enlarged but still show reasonably normal architecture. The sinusoids and the hilar region of the lymph nodes show some increase in the lymphocytic infiltration. There are quite a number of mitotic figures present in the lymph nodes, especially in the germinal centers. In some of the lymph nodes there are a few eosinophiles. The lungs show slight lymphocytic infiltration in the alveolar wall, but most of the lymphocytes are perivascular. The most striking change in the rabbit is in the liver where there is dense lymphocytic infiltration around the blood vessels at the periphery of the liver lobules. There are also lymphocytic infiltrations around the biliary capillaries. The spleen shows some increase in pigmentation and some evidence of increase in the amount of cellular debris but is otherwise normal.

The histologic examination of the rabbit brain which had been inoculated directly with the virus shows the most striking change. The arachnoid is densely infiltrated with lymphocytes. In spite of the fact that there is considerable thickening of the arachnoid and dense infiltration with lymphocytes, no polys are present. There is also considerable cellular debris in the arachnoid, and some of this debris is being phagocytized by large mononuclears. The brain substance in some areas is densely infiltrated with lymphocytes, particularly in the basal portions around the brain stem. Sections of the sixth passage of rabbit brain shows the most advanced pathologic processes. There is a moderate amount of death of brain cells, particularly the large ganglion cells. The cells are shrunk away from

the brain tissue and show some pyknosis. A few show small astrocytes around them.

Guinea pigs inoculated intraperitoneally showed some increase in the size of the lymph nodes. Histologically these lymph nodes show more changes than those found in the rabbit. The entire lymph node is densely infiltrated with lymphocytes, and the normal markings appear to be compressed. The entire area is densely infiltrated and some of the larger cells appear to be lymphoblasts. There is an occasional eosinophile in the sections. The spleen appears to be normal. The sections of the liver also show perivascular infiltration of lymphocytes at the periphery of the lobules.

Sections of mouse brain inoculated directly with the virus show similar pathologic processes to those seen in the rabbit. The lymphocytic infiltration of the arachnoid and pia is marked, but there is considerably more infiltration of the brain substance. This is particularly true around the ventricular spaces.

The pathologic condition of the animals studied demonstrates that the virus when inoculated into animals gives rise to a generalized lymphocytic infiltration no matter in what manner the virus is inoculated.

DISCUSSION OF THE EXPERIMENTAL DATA

Several pieces of tissue obtained from the submaxillary gland and adjacent lymph nodes were inoculated into tissue culture, mice, guinea pigs, and rabbits. The tissue culture was passed serially and eventually became infectious for mice. The intracerebrally inoculated rabbits developed an encephalitis, and their brains contained an agent which could be transmitted from one rabbit to another. With each passage the incubation period was decreased and the severity of the encephalitis increased. Six consecutive

passages were accomplished in rabbits. The rabbit brain inoculated into tissue culture became infectious for mice. The original guinea pigs inoculated also developed encephalitis and the agent was successfully transmitted in guinea pigs three times. The substance present in guinea-pig brain, after passage in tissue culture, became infectious for mice.

The infectious agent when grown in tissue culture was transmitted to mice, rabbits, and to a lesser degree to guinea pigs. The potency of the agent in passage in mice had been increased to 10^{-7} dilution. The potency in tissue culture when tested in mice had been increased to 10^{-6} . When the virus was grown in tissue culture, the optimum requirement for highest titre was four days at 37°C . There was no visible change in the appearance of the tissue culture when the titre of the infectious agent was highest. We, therefore, obtained from the original tissue by three different methods an agent which produced identical symptoms in each test animal when passed from one to another.

Whenever an apparently new virus is discovered by animal inoculation, there is always a possibility that a latent virus was stimulated in the animal inoculated. There are several methods of determining whether the virus found was present in the animal inoculated. Most viruses have a definite host range. This is particularly true of Theiler's virus, which is usually picked up in the mouse and is noninfectious for rabbits and only slightly infectious for guinea pigs. The mice inoculated directly with this material did not develop symptoms. If the virus encountered had been Theiler's, herpes, or some other virus, the inoculation of mice would have immediately produced symptoms.

There was no evidence of neutralizing antibodies in normal rabbit blood, normal mouse blood, or normal guinea pig blood. Normal human serum also failed to neu-

tralize the virus. Only two human sera have been found that possess neutralizing antibodies to the virus—the patient from whom the original tissue was obtained and another individual who is suffering from a peculiar type of lymphoid disease. Our disease is probably not related to Hodgkin's or similar lymphoma since none of the serum tested from patients with these diseases possessed neutralizing antibodies.

The virus when inoculated intracerebrally into animals gave rise to an encephalitis in which the cellular reaction was entirely lymphocytic. When inoculated intraperitoneally and intravenously, there was an increase in the lymphocytic elements with a marked decrease in the leukocytic cells. The virus may destroy the leukocytes rather than increase the lymphocytes since there was no appreciable increase in the number of white blood elements present.

The virus could be one of the causes of pseudotumor of the orbit. It is known that in pseudotumor of the orbit many patients develop exophthalmos which persists for a long period of time but may spontaneously disappear with or without treatment. Some pseudotumors of the orbit persist for long periods of time and develop into a definite tumor with persistent exophthalmos. When these are removed, results are usually good. The third type of pseudotumor is, in some respects, similar to that of the patient presented here in that the tumor increases in spite of treatment and is histologically indistinguishable from some of the lymphomas. Whether the virus found in this patient has any relationship to the usual lymphoma has not been determined.

From the blood-neutralization experiments, it would appear that the virus has no relationship to Hodgkin's disease. Insufficient data are at hand to determine this point at the present time. It may be that the virus can give rise to several types of lesions which vary from entirely benign to potentially malignantlike tumors so that when present in the lymphoid tissue it may give rise to a quasi-lymphoma.

An attempt is being made to isolate a virus from the only other patient who had neutralizing antibodies to the virus. The amount of material obtained from this patient was relatively small, and at the present time it is doubtful that we will recover a virus from this patient.

CONCLUSIONS

1. A preliminary report of a new virus is presented.

2. This virus was obtained from lymph nodes and submaxillary gland of a patient suffering from a type of malignant exophthalmos.

3. The virus produces an encephalitis in rabbits, guinea pigs, and mice and grows well in tissue culture.

4. The cellular response to the virus in animals is predominantly lymphocytic.

5. The virus is small in size and is submicroscopic.

6. The virus is neutralized by blood serum from the patient.

7. Normal human serum and the blood serum of most laboratory animals contain no neutralizing antibodies.

8. The virus has not been identified in any known classification.

635 West 165th Street (32).

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DISCUSSION

DR. F. H. VERHOEFF (Boston, Massachusetts): I would like to ask what happened to the patient. What was the further course. Did he recover?

DR. ALSON E. BRALEY (New York): He was given X-ray treatments. When last heard from, his progress was satisfactory. Although he thought he was slightly improved, he had no vision in either eye and there was marked exophthalmos. He had been given a large number of X-ray treatments.

DR. VERHOEFF: Your explanation is that the case is one of an atypical pseudo-tumor.

DR. BRALEY: Yes, sir.

DR. VERHOEFF: This might simply be one of the more severe cases. Some of these patients have much more resistance.

I also wanted to point out that at the time you first saw this patient there was a tremendous lymphoma and granuloma, and that you found what I think is a characteristic thing—a little lymphoid follicle, with profuse obliteration of the blood vessels.

DR. PARKER HEATH (Boston, Massa-

chusetts): I would like to ask a question. Do you classify this man as a case of real Brill-Shimmer's disease?

DR. BRALEY: No, sir, I don't know how we should classify him. I have looked over all his slides from 1938 to the present time, and there is a tremendous variation in the microscopic appearance of the tumor. The first biopsy of the orbit looked like a giant follicular lymphoma, and as you can see from the last biopsy, it looks like an inflammatory lesion of the submaxillary gland and the lymph nodes. I think we might call some of these lesions quasi-lymphomas or lymphatoid lesions.

DR. VERHOEFF: Was there a lot of fibrosis in the last one?

DR. BRALEY: Not so much in the last, but lots of fibrosis was present in the first biopsy.

DR. HEATH: This also enters the realm of the neuropotential, in the change in cells from one grade to another.

DR. VERHOEFF (closing): It is certainly refreshing to discover something from these pathologic processes. We try but we generally don't get anything.

CYANIDE INHIBITION OF CORNEAL RESPIRATION*

W. A. ROBBIE, PH.D., P. J. LEINFELDER, M.D., AND T. D. DUANE, M.D.
Iowa City, Iowa

Metabolic processes in the cornea have not been extensively studied, even though this tissue is well adapted to experimental investigation. The importance of such information in contact-lens fitting, corneal transplantation surgery, and similar fields is obvious. The avascular nature of the tissue and the low rate of oxygen consumption might suggest that the respiratory mechanisms involved are of a different nature than those in other types of mammalian tissue. Yet preliminary studies indicate that the essential components of certain dehydrogenase and cytochrome systems are present.¹

Inhibition of heavy metal catalysis by cyanide is a means of determining the activity of cytochrome oxidase in tissue respiration without disrupting the normal cellular structure. The drug is effective in low concentrations, is relatively specific in its action, and penetrates cell membranes readily. Herrmann, Moses, and Friedenwald¹ found that both cyanide and azide produced some inhibition of the intact bovine cornea, and that the addition of cytochrome-c to ground and dialyzed corneal tissue resulted in an increased oxygen uptake when hydroquinone or phenylenediamine were present as substrates. From these findings they concluded that the cytochrome system plays a part in the normal oxidative processes. Because the technique of controlling cyanide concentration in manometric experimentation has recently been improved² a more extensive study has been made to

determine how much of the normal respiration may be dependent upon an iron-containing enzyme complex.

METHODS

* Respiration measurements were made with Warburg manometers at 37.5°C., using flasks of about 7-cc. capacity. Each flask received one cornea, cut in half to prevent folding, from a rabbit of 1½ to 3 kilograms weight. Unless otherwise indicated, 1.0 cc. of pH-7.4 Ringer-phosphate buffer containing 0.2-percent glucose³ was added, and 0.6 cc. of 10-percent KOH solution or 10-percent Ca(OH)₂ suspension was placed in the center well on filter paper to absorb CO₂. In the experiments with cyanide, 0.1 cc. of neutralized KCN solution of 10 times the desired final concentration was added to 0.9 cc. of the buffer in the flask after the cornea had been added, and 0.6 cc. of the Ca(CN)₂-Ca(OH)₂ solution having an equivalent HCN tension² was placed on filter paper in the center well. In the experiments testing recovery from cyanide exposure the corneas were removed from the flasks at the end of the exposure period, rinsed in buffer, and returned to the washed flasks which now contained fresh fluid and center-well solution without cyanide.

Results are expressed in terms of dry weight. After each experiment, the corneas were rinsed in distilled water, laid on cover glasses, and weighed after drying to constant weight at 100° to 110°C.

RESULTS AND DISCUSSION

There is a definite and consistent inhibition of corneal respiration by the higher concentrations of cyanide, as shown in Figure 1. The oxygen consump-

*From the Department of Ophthalmology, College of Medicine, State University of Iowa. Aided by a grant from the John and Mary R. Markle Foundation. Read at the 16th scientific meeting of the Association for Research in Ophthalmology, Inc., Atlantic City, June 10, 1947.

tion of the control tissue is constant for more than six hours, and the corneas in cyanide have constant rates also at levels

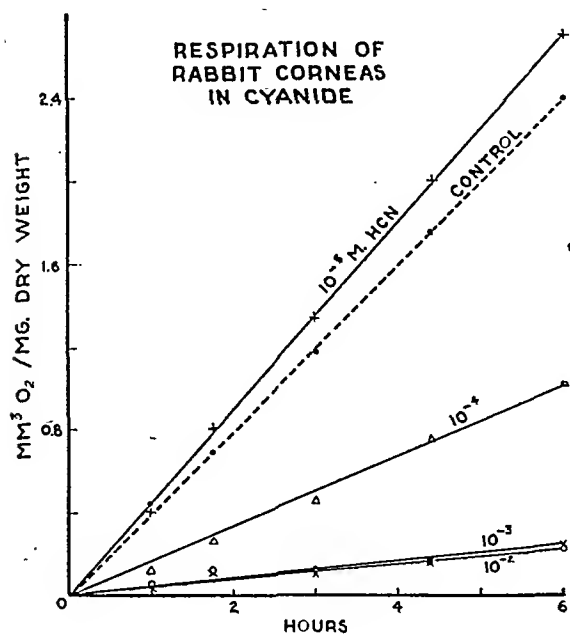


Fig. 1 (Robbie, *et al.*). Oxygen consumption of whole rabbit corneas in various concentrations of cyanide.

which vary with the HCN concentration. This variation with concentration is illustrated more completely in Figure 2, which shows the inhibiting effects of a range of concentrations from 10^{-2} to 10^{-6} M.

A 10^{-4} M. HCN produces about 50 percent inhibition of respiration, and 10^{-3} M. leaves a residual oxygen consumption of less than 10 percent. It is apparent that a cyanide-sensitive enzymatic system is responsible for most of the normal corneal oxygen uptake.

Riboflavin deficiency produces corneal vascularization in rats,⁴ a finding which suggests that this vitamin is in some way involved in corneal oxidative metabolism. The riboflavin may play its part as a hydrogen carrier that is autoxidizable and reacts directly with molecular oxygen, or it may be used in a flavoprotein intermediate that serves as a connecting link between the dehydrogenases and the cyto-

chrome system. If its main function were the former and if it were a highly active factor in corneal metabolism, one would expect the respiration of the tissue to be quite insensitive to cyanide. However, if its main role is that of an intermediary which interacts with the cytochrome system, the oxygen consumption should be blocked by cyanide. The latter scheme of action appears the more probable.

Recovery of respiration upon the removal of cyanide is rapid. By the time a cornea is washed, returned to the manometer, and reequilibrated, recovery is almost complete. This is demonstrated by the experimental results presented in Figure 3. The cornea which was removed from the cyanide solution and washed after a 15-minute period of inhibition showed about the same oxygen uptake as the control (curve 1). The flask which was set up with HCN in the fluid but with KOH in the center well rather than a properly balanced alkali-cyanide mixture, lost HCN gas to the KOH so rapidly that again recovery was almost complete before a measurement could be made (curve 2). Pronounced inhibition occurred, however, when the center-well

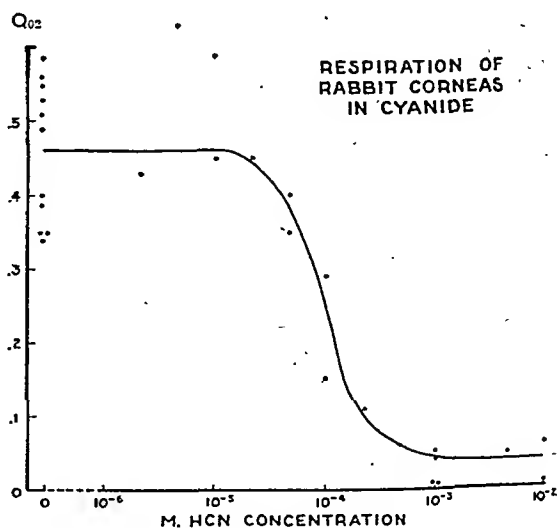


Fig. 2 (Robbie, *et al.*). Variation in corneal respiration with HCN concentration. Each determination is for a 2-hour measurement period.

solution had an HCN tension equivalent to that of the fluid in the flask (curve 4). The importance of maintaining the proper concentrations of HCN gas in the manometer flasks by the use of center-well solutions of equivalent HCN tensions is obvious.

The nature of the linkage between cyanide and the ferric iron in cytochrome oxidase is not definitely known. If the combination were stable, recovery would occur only as rapidly as new enzymes were formed. The evidence presented in the recovery experiments illustrated in both Figures 3 and 4 indicates that the union in this particular tissue at least is very labile, and that a constant tension of HCN gas must be maintained in the manometer flask to inhibit a constant portion of the respiration.

In manometric work with tissue slices the limiting thickness which still permits adequate oxygenation is determined by the rate of respiration of the tissue, the

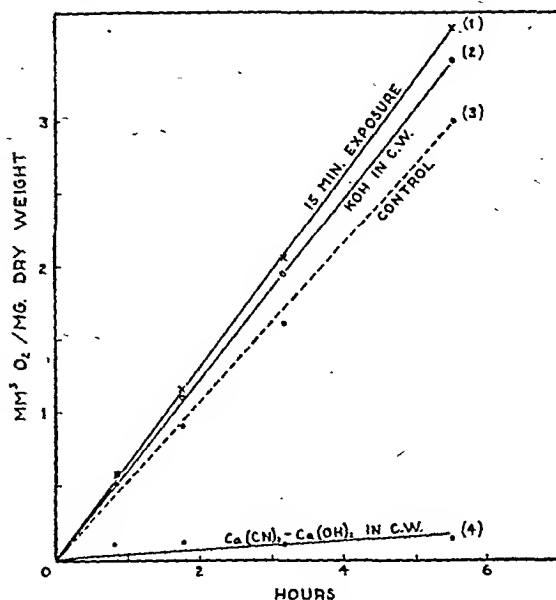


Fig. 3 (Robbie, *et al.*). Experiment demonstrating the importance of maintaining proper HCN equilibrium in manometric experiments. For explanation see text.

coefficient of diffusion of oxygen through the tissue, and the oxygen tension of the gas phase.⁵ The cornea exceeds the maxi-

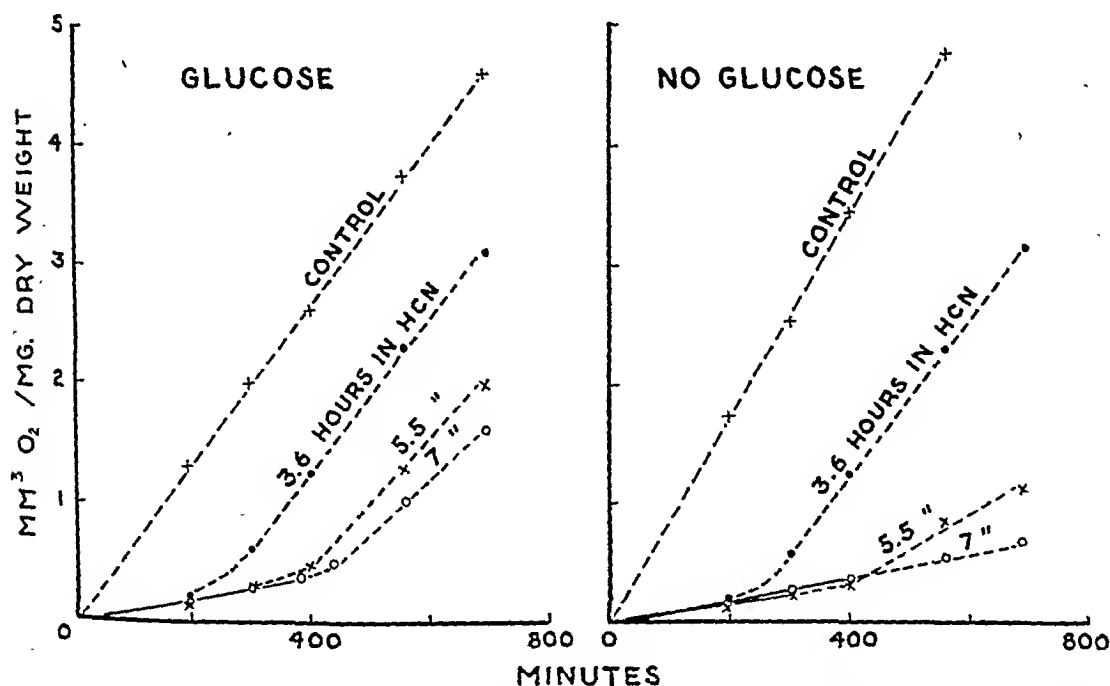


Fig. 4 (Robbie, *et al.*). Recovery of corneas after various exposures to 10^{-3} M. HCN. 0.2-percent glucose in buffered saline solution for first experiment; no glucose in fluid used in second experiment.

imum thickness which is permissible with most other tissues; but, since both the rate of respiration and the rate of diffusion of gas undoubtedly vary in the different structural components, it is not practicable to determine the limiting thickness on a theoretical basis. Fischer⁶ has shown that the cornea normally uses oxygen directly from the air, and Lee and Hart⁷ found little change in oxygen uptake when rat corneas were measured in

contribute to the total by measuring the oxygen consumption of the whole cornea and that remaining after the epithelium and endothelium have been removed. Table 1 presents the results of a number of measurements on normal corneas and those which have had the two outer layers scraped off. The oxygen consumption of the stroma layer is one third that of the whole cornea. Since the weight of this portion is about 15 times that of the re-

TABLE 1
OXYGEN CONSUMPTION OF INTACT CORNEA, CORNEA WITH EPITHELIUM AND ENDOTHELIUM REMOVED BY SCRAPING, AND ESTIMATED VALUE FOR EPITHELIUM

Tissue	Number of Determinations	Mean Q_{O_2} ($MM^3O_2/Mg.$ Dry Weight/hour)	Range
Entire cornea	18	0.46	0.30-0.63
Stroma	22	0.15	0.07-0.25
Epithelium (estimated)	—	6 to 8	—

pure oxygen rather than air, indicating that respiration is maximum in air. In the present series of experiments several determinations were made using oxygen as the gas phase, and the rate of metabolism was found to be about the same as in air. The fact that the corneas may be used without the disturbance in normal structure which occurs when a tissue is sliced makes them favorable for certain types of long-term experiments. An indication of the normality of the tissue is given by the course of the oxygen uptake curves as shown in the figures. The control corneas may run for as long as 12 hours without a decrease in the rate of respiration.

The oxygen consumption of the intact cornea is due to the respiration of the epithelial and endothelial layers and to the relatively inactive stroma. It is impossible to strip off the two soft layers without injuring them drastically, but it is possible to estimate the amount of respiration they

maintaining layers it is apparent that its rate of metabolism is actually very low. The calculated value for the Q_{O_2} of the combined epithelium and endothelium is of the same order as that for other soft tissues such as liver, but the rate of respiration of the stroma is only one fortieth this amount. Since the stroma layer is primarily structural in function, a low level of oxygen consumption is probably sufficient to take care of its metabolic requirements. The functionally more active epithelium is ordinarily in close contact with air and direct diffusion can provide sufficient oxygen. Previous investigators who have measured the respiration of the rabbit cornea have reported somewhat higher values for the Q_{O_2} than that shown in Table 1. Kohra⁸ lists a figure of -1.56, and Orzalesi⁹ gives -2.09 for the Q_{O_2} values.

The scraped corneas are inhibited by cyanide to about the same extent as the intact ones, and 10^{-3} M. HCN produces

almost complete inhibition of respiration.

Living cells require continuous expenditure of energy for maintenance purposes. If this energy supply is blocked for a certain critical period, the cell dies. Most mammalian tissues may utilize carbohydrate by either aerobic respiration or glycolysis, and the cornea is apparently no exception. When atmospheric oxygen is available, most of the glucose substrate is metabolized to carbon dioxide and water. Under anaerobic conditions, possibly also when the eyes are closed and the oxygen tension is considerably reduced, the glucose breakdown proceeds only as far as lactic acid. Cyanide treatment produces the same result, because the normal oxidative pathway is blocked by cytochrome-oxidase inhibition. In either of these cases, the energy for survival may come from the glycolytic process and the cornea survives. With cyanide exposure, the glycolysis rate is increased because of inhibition of the Pasteur mechanism; the rate of corneal glycolysis in bicarbonate buffer is doubled by 10^{-3} M. HCN.

Figure 4 illustrates an experiment in which corneas were inhibited by cyanide for various periods and the recovery then observed. Although the respiration was depressed by the cyanide to 10 percent of the normal level for as long as seven hours, it came back immediately to the original level if glucose was present as substrate. The corneal cells apparently obtained their maintenance-energy requirements by glycolysis. The situation was quite different with those corneas that did not have added glucose as substrate. There was no recovery from a 7-hour exposure to cyanide even if glucose was added at the end of the period of inhibition. In this case the energy supply was probably interrupted at both the respiratory and glycolytic levels, the former by the cyanide and the latter by lack of substrate. The deprived cells

simply exceeded the tolerance limit for energy deprivation and were irreversibly affected.

Control corneas with no added glucose will respire uniformly for at least 12 hours at a rate which is the same or higher than those supplied with substrate. This respiration is almost completely inhibited by cyanide, indicating that it is probably due to carbohydrate oxidation. Since no glucose has been added, the cornea itself must contain the source material. It is quite possible that the mucoprotein which contains carbohydrate and comprises about 4 percent of the cornea¹⁰ is an adequate source for normal respiration for a long period. However, more than 10 times as much glucose must be converted by glycolysis to lactic acid to produce energy equivalent to that released when the substrate is completely oxidized. A source that might be adequate for respiration may soon be used up if the tissue depends only upon glycolysis for its energy. This rapid depletion of the carbohydrate reserve may depress the glycolytic process, and after seven hours in cyanide, as shown in Figure 4, the tissue can no longer recover. A comparable situation has been reported for brain tissue.¹¹ After exposure without substrate to anaerobic conditions there was an irreversible loss of glycolytic capacity due to nonregeneration of adenosine triphosphate.

SUMMARY

The respiration of the cornea is almost completely inhibited by 10^{-3} M. HCN, indicating that most of the oxygen consumption is probably mediated by a cytochrome-cytochrome oxidase system. A 10^{-4} M. cyanide produces about 50-percent inhibition. Recovery from cyanide exposure is rapid, and it is necessary to maintain a constant tension of HCN gas in the manometer flasks by the use of a properly balanced alkali-cyanide center-

well absorbing solution.

Most of the oxygen consumption of the intact cornea is due to the epithelial layer. The Q_{O_2} of this portion is about -6 to -8 , comparable to other soft tissue such as liver. The stroma which has been denuded of epithelium and endothelium by scraping has a very low rate, a Q_{O_2} of -0.15 .

Corneas may be 90 percent inhibited by cyanide for seven hours or longer and will recover quickly and completely upon removal of the cyanide, if glucose is present in the suspension fluid. If the fluid contains no substrate, there is no recovery after this exposure period.

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DISCUSSION

DR. V. EVERETT KINSEY (Boston, Massachusetts): I would like to propose an alternative explanation to account for the increased effect of cyanide poisoning in the absence of glucose. I think, in general, the reversible poisons like HCN act by virtue of their ability to complete favorably for their substrate, in this case the substrate being cytochrome oxidase. Therefore, when you have glucose present, a certain number of molecules of glucol, if you like, combined with its substrate, the cytochrome oxidase, and when you have cyanide present, you have the competition of cyanide and glucose for the cytochrome oxidase.

I cannot cite the experiments, but I think there is a good deal of evidence in the literature that that is a mechanism which is fairly common, and I believe it

will account for your results equally well with the one which you propose.

DR. W. A. ROBBIE (Iowa City, Iowa): There is another type of experiment which has been performed that expresses in chemical language what I have said from the cellular standpoint. Some workers on brain metabolism found that in the absence of glucose, the glycolytic process, the ability to carry on glycolysis, was lost after a few hours. They found that this was due to the disappearance of adenosine triphosphate (ATP), and that the reaction was irreversible. After the tissue had gone for a certain length of time without any substrate, it was unable to produce this high-energy phosphate-bond linkage, which apparently is necessary for survival. Perhaps that is saying the same thing that I said in more chemical terms.

VISUAL EFFECTS OF TRIDIONE*

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A new synthetic compound, Tridione (3, 5, 5-trimethyloxazolidine-2,4 dione, Abbott) has recently been used as an anti-convulsant in the treatment of epilepsy. A number of papers¹ describing the results obtained with this new drug mention the fact that patients frequently complain of visual symptoms associated primarily with high illumination. Such symptoms are reported by a majority of adults and adolescents, occasionally by younger children. The only paper devoted specifically to the discussion of the visual phenomena is a brief note by Vail,² who reports that some patients experience difficulty in discriminating black or colors against light backgrounds and that visual acuity, although normal in low illuminations, may decrease to about 20/100 when the chart is illuminated to the customary level. It is reported that no external or ophthalmoscopic changes were found to account for these abnormalities in visual function.

The purpose of this paper is to report the results of a series of tests of visual function which provide further information as to the nature of the unusual visual phenomena associated with Tridione therapy. In preliminary studies, attempts were made to measure visual acuities for a wide range of illuminations including the high levels normally occurring outdoors. It was found that the previous state of adaptation of the eye and also its time of exposure to the brightness level at which acuity is measured are very impor-

tant factors and must be carefully controlled if reproducible measurements are to be obtained. Marked reduction in acuity can, for example, be demonstrated immediately after change in the illumination from a moderate to a high level and vice versa, in patients showing little or no impairment of acuity after exposure for 10 minutes or more to the brightness level at which acuity is measured. Therefore, in the experimental procedures finally adopted, tests of visual function were made primarily at two brightness levels, 2 millilamberts and 2,000 millilamberts, and emphasis was placed on measurements of the rate of recovery of visual function with continued exposure to each brightness level. Tests of both visual acuity and differential brightness sensitivity at the fovea were used in the experiments. Supplementary studies included determinations of the light threshold, tests of color discrimination at high intensity, and tests of sensitivity to flicker.

The subjects were seven patients from the Baltimore City Hospitals, one aged 30 years, the others between 56 and 68 years of age. Those with uncorrected vision of 20/30 or better did not wear glasses during these tests. All tests were made with the natural pupil. In most experiments only one eye was tested. Comparison of the results of monocular and binocular tests of acuity in two patients showed the results to be essentially similar. The dosage of Tridione was 1 gm. per day in six cases, 3 gm. per day in one case, that of R. DeC. The patients were studied while on Tridione for periods varying from two to nine months. Recovery from the visual changes after discontinuance of the drug was studied in three cases.

* Read at the 16th scientific meeting of the Association for Research in Ophthalmology, Inc., Atlantic City, June 10, 1947. From the Wilmer Ophthalmological Institute of the Johns Hopkins University and Hospital and the Baltimore City Hospitals.

The authors are indebted to Miss Lorraine Wollach for assistance in giving the tests employed in this study.

I. VISUAL ACUITY

1. APPARATUS

Visual acuity was tested with a special series of charts composed of Landolt rings which, at a distance of five meters, corresponded to acuities of 0.1, 0.15, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 1.25, 1.50, and 1.75. In each size four positions of the break in the ring—up, down, right, and left—were used. The smallest size at which the patient could read correctly at least three of the four figures was taken as the measure of his acuity. Each group of figures was mounted on a piece of white cardboard, five inches in width,

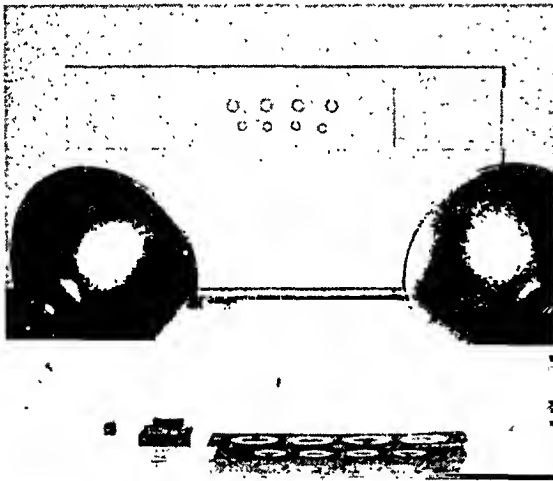


Fig. 1 (Sloan and Gilger). Arrangement of equipment for testing visual acuity.

which could be slipped into guides at the center of a white cardboard screen. At five meters this screen subtended a visual angle of 11.5 degrees in the horizontal and 5.8 degrees in the vertical dimension (fig. 1). With these charts it is possible to make repeated rapid measurements of acuity without any possibility of memorizing by the patient. High intensities of illumination were obtained by means of two 500-watt photoflood lamps enclosed in bowl-shaped reflectors. The distance of these from the screen was adjusted to give an even illumination of the desired amount. Lower intensities of illumination

were provided by ordinary incandescent lamps in ceiling fixtures. A Macbeth Illuminometer was used to measure the brightness of the white background of the test charts.

2. RESULTS

A. Recovery of visual acuity at 2,000 millilamberts after adaptation to 2 millilamberts. In these tests the eye was first exposed for 10 minutes to the white screen illuminated to a brightness of 2 millilamberts. The illumination was then increased to give a brightness of 2,000 millilamberts, and measurements were made immediately and as rapidly as possible thereafter until acuity reached a constant level. When the increase in acuity was relatively slow it was possible to obtain very accurate measurements of the time required to reach each successive level of acuity. When recovery was rapid the successive stages could be measured only approximately.

The results of such tests are shown in Figures 2 to 5. In these graphs the times of exposure to 2,000 millilamberts are plotted on the abscissa, the corresponding acuities in logarithmic units on the ordinate. A logarithmic scale of acuities is used, rather than a linear scale, because it minimizes on the graph the unavoidable fluctuations in acuity which occur as the maximal level is approached.

In order to obtain comparative data on the normal rate of recovery of acuity, this test was given to four of the patients prior to Tridione therapy. While there may be, in normal subjects, a momentary reduction in acuity with sudden change in brightness from 2 to 2,000 ml., the time required to reach maximum acuity was less than one minute in every case and therefore could not be measured accurately by the procedures used in this study. Craik,³ using more accurate methods of measurement, found no significant reduc-

tion when acuity was measured within two seconds after change in brightness from about 1 to 1,000 ml.

The patients on Tridione, however, all showed a significant reduction in acuity immediately after exposure to the high brightness. Figure 2 gives typical recovery curves for each of the seven patients. In five cases the acuities were 20/200 or less after only one minute of exposure to the high brightness. With longer exposure, the acuity increased gradually, then reached a constant level. For most subjects this final level was equal to or better than that at 2 ml. Impairment of acuity is, therefore, only temporary and after sufficient time of

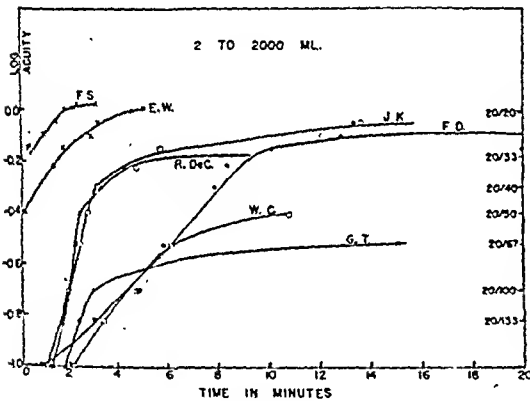


Fig. 2 (Sloan and Gilger). Rate of recovery of acuity after change from 2 to 2,000 ml. Typical curves for each patient. In normal subjects recovery is practically instantaneous.

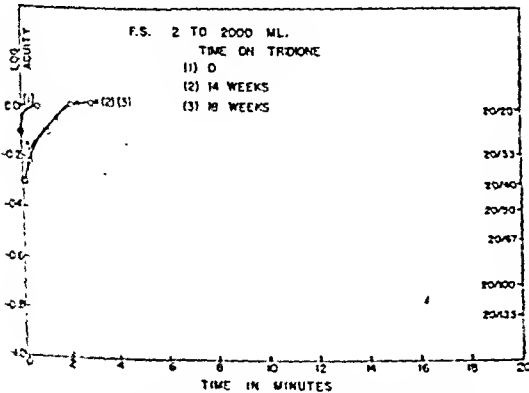


Fig. 3 (Sloan and Gilger). Change in rate of recovery of acuity with duration of therapy. Subject F. S.

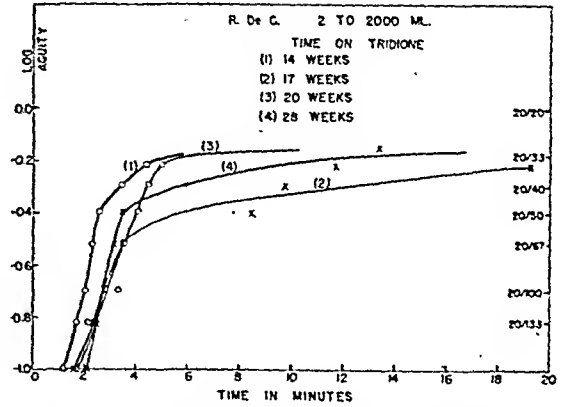


Fig. 4 (Sloan and Gilger). Change in rate of recovery of acuity with duration of therapy. Subject R. De C.

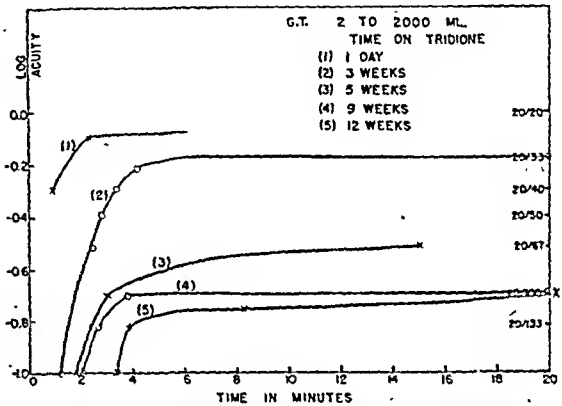


Fig. 5 (Sloan and Gilger). Change in rate of recovery of acuity with duration of therapy. Subject G. T.

exposure to the high brightness there is no measurable defect. The recovery curves of two patients, W. C. and G. T., however, revealed a marked reduction in acuity even after adaptation for 10 or more minutes to the high brightness. The course of the recovery curves indicates that in these patients there was lasting impairment of acuity at the high brightness level, demonstrable even after long-continued exposure.

The rate and extent of recovery of acuity varied with duration of therapy. Five patients were tested at intervals while taking Tridione for periods of time varying from 7 to 28 weeks. Progressive changes in the recovery curves of three

patients illustrating different degrees of defect are shown in Figures 3 to 5. F. S. showed only a slight impairment of essentially the same degree after 14 and 18 weeks of therapy. For R. DeC., the rate of recovery was slower after 17 than after 14 weeks. The curves for 20 and 28

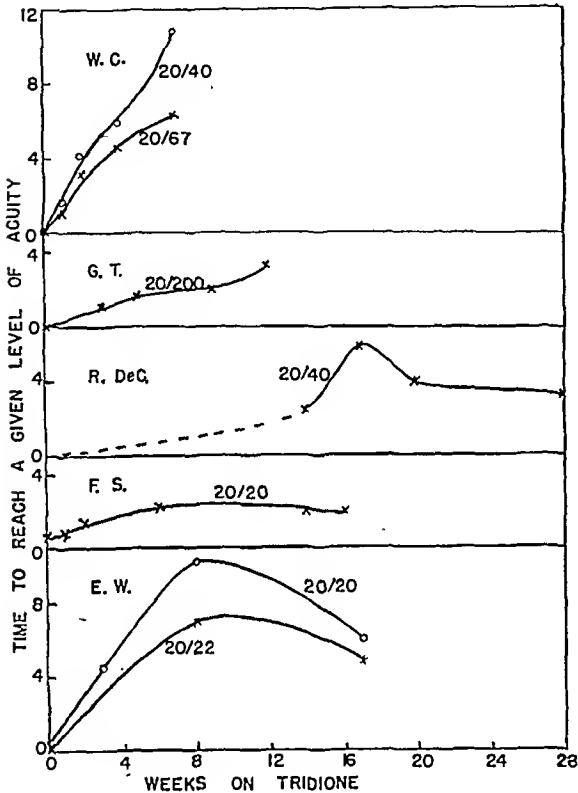


Fig. 6 (Sloan and Gilger). Changes in rate of recovery of acuity at 2,000 ml. with duration of therapy. The time required to attain a given acuity is taken as an index of rate of recovery.

weeks of therapy, however, showed no further progressive impairment and in fact some evidence of improvement. G. T., followed for only 12 weeks on Tridione, showed marked impairment increasing in severity with duration of therapy.

The relationship between delay in recovery of acuity and duration of therapy is also shown in Figure 6. This chart gives the time required to reach a given level of acuity. The acuities chosen in each case are indicated on the individual curves. It is apparent from these curves

that for all five patients there was a gradual slowing in rate of recovery during the first seven weeks. The results for those followed for 14 weeks or more indicate that after long-continued therapy the recovery curves become approximately constant or show slight improvement, suggesting that the patients gradually developed a tolerance to the visual effects of the drug. It is of importance to determine in future studies whether patients with marked defects, such as were manifested by our subjects, W. C. and G. T.,

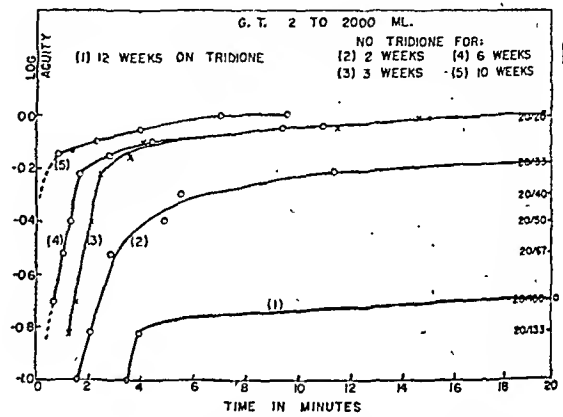


Fig. 7 (Sloan and Gilger). Improvement in recovery curves of acuity at 2,000 ml. when Tridione was discontinued. Subject G. T.

also reach a constant level of impairment after long periods on Tridione.

Three patients, G. T., F. D., and J. K., whose recovery curves were measured 8 or 10 weeks after Tridione was discontinued, all had approximately normal rates of recovery at this time. Figure 7 shows for G. T. the gradual restoration to normal during a period of 10 weeks.

B. Recovery of acuity at 2 millilamberts after adaptation to 2,000 millilamberts. The results reported in the previous section indicated that Tridione produces a delay in the rate of light adaptation, as measured by tests of visual acuity. It might be expected, therefore, that the reverse change from high to low brightness would also produce a similar temporary

impairment of visual acuity. Studies were therefore made to test this assumption.

With change from 2,000 to 2 ml., normal subjects and patients tested prior to Tridione therapy reached a maximum acuity in less than one minute. A typical recovery curve for each of the six patients given this test is shown in Figure 8. The individual differences in rate of recovery correspond closely to those of the previous test. As before, F. S. and E. W. showed the most rapid rates, G. T. and W. C. the slowest. Adaptation of one eye to the high brightness did not produce any impairment in the unexposed eye when the latter was tested at 2 ml.

Recovery of acuity with change from high to low brightness differs in one important respect from that observed with change from low to high brightness. The final level of acuity at 2 ml., reached after continued exposure to this brightness, was in no case lower than the acuity prior

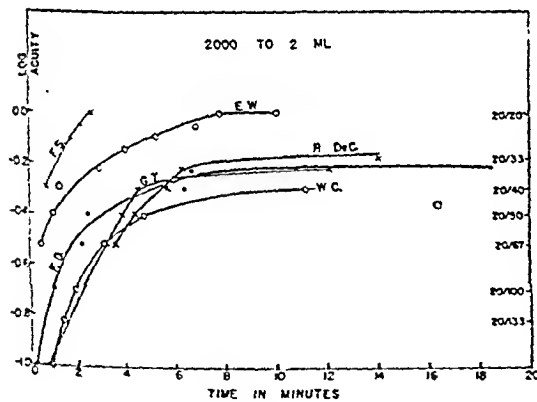


Fig. 8 (Sloan and Gilger). Rate of recovery of acuity after change from 2,000 to 2 ml. Typical curves for each patient. In normal subjects recovery is practically instantaneous.

to therapy. There is, therefore, no evidence of lasting impairment at the low brightness such as was observed in several patients at 2,000 ml.

C. Variation of acuity with intensity. It was shown in the previous sections that after adequate time of adaptation to the

brightness at which acuity was measured all subjects had normal acuity at 2 ml., while some showed significant impairment at 2,000 ml. Measurements of acuity at intensities between 2 and 2,000 ml.

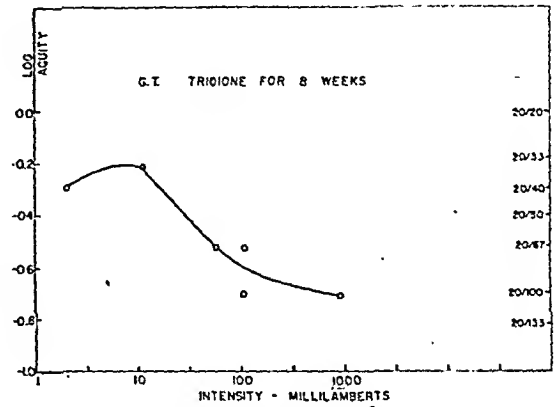


Fig. 9 (Sloan and Gilger). Variation of acuity with light intensity. Subject G. T. In these tests the eye was adapted to each brightness before acuity was measured.

were made for G. T., one of the patients showing markedly reduced acuity at 2,000 ml. The tests at each intensity were continued until there was no further improvement in order to insure that maximal acuity was reached. The results are shown in Figure 9. Brightness in log units is plotted on the horizontal coordinate, acuity in log units on the vertical. At 10 ml., the acuity of 20/33 was equal to that prior to therapy. At 50 ml., it decreased to 20/70; at 1,000 ml., to 20/100. The fact that this patient complained of impaired vision only in outdoor illuminations is consistent with these findings, since indoor brightnesses are seldom greater than about 30 ml.

II. DIFFERENTIAL BRIGHTNESS SENSITIVITY

1. APPARATUS

The test for brightness discrimination employed gray strips (1° by 0.5°), mounted on a white background. The percent contrast depends upon the reflect-

ances of the strip and the background and is given by the formula: percent contrast equals $100(R_b - R_s)/R_b$ where R_b is the reflectance of the white background (0.88), and R_s that of the strip (0.80 to 0.024). The eight steps of contrast are

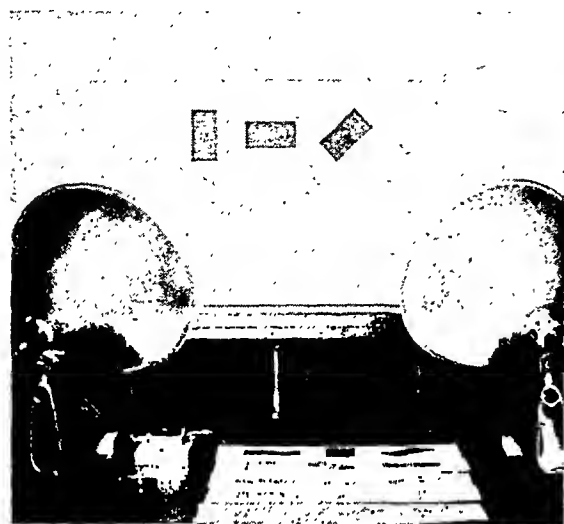


Fig. 10 (Sloan and Gilger). Arrangement of equipment for testing contrast (differential brightness) sensitivity.

9.1, 30.3, 50.0, 64.1, 76.5, 88.1, 95.4, and 97.5 percent. Three strips in different orientations were used at each contrast level. The patient was required to report whether the orientation of each strip was horizontal, vertical, or diagonal. The minimum perceptible contrast is taken as that at which the position of all three strips was named correctly. As in the acuity tests, the charts were shown at the center of the large white cardboard screen (fig. 10). The provisions for illumination of the chart and surrounding area were the same as those employed in the tests of visual acuity.

The minimum contrast perceptible by the normal eye is about two percent at high-brightness levels. In these studies no attempt was made to provide contrasts smaller than 9 percent because of the difficulties in measuring and standardizing smaller differences in reflectance. For this

reason and because the contrast steps are relatively large, this test equipment is suitable only for the measurement of relatively gross changes in contrast sensitivity.

2. RESULTS

A. Recovery of differential brightness sensitivity at 2,000 millilamberts after adaptation to 2 millilamberts. Four patients tested prior to Tridione therapy were all able to perceive the smallest contrast step (9 percent) within six seconds after a sudden change from low to high brightness. Figure 11 gives typical recovery curves for each of the six patients given this test while on Tridione. The two showing the most rapid recovery, F. S. and E. W., required more than three minutes of exposure to the high brightness before they were able to perceive the 9-percent contrast. Three patients with slower rates of recovery, F. D., R. DeC., and G. T., required from four to five minutes to detect the 30-percent contrast. The slowest rate of recovery was shown by W. C., who required about eight minutes to see the 30-percent contrast and

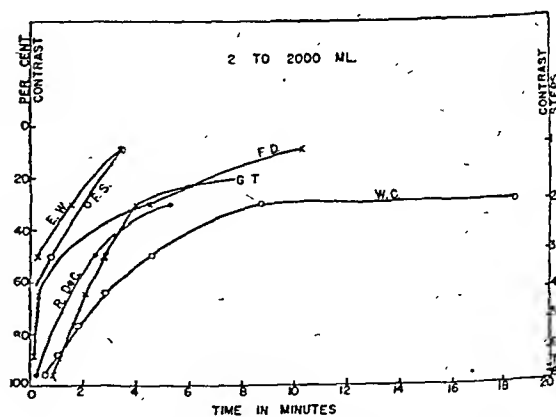


Fig. 11 (Sloan and Gilger). Recovery of contrast sensitivity after change from 2 to 2,000 ml. Typical curves for each patient. In normal subjects recovery is practically instantaneous.

could not get the next step (9 percent), after an exposure of 18 minutes to the high brightness. Figure 12 shows changes

in the recovery curves with time on Tridione for G. T., one of the patients with a relatively slow rate of recovery. After 12 weeks he was unable to distinguish a strip 50-percent darker than the background even after long exposure to the high brightness. Recovery of contrast sensitivity after the drug was discontinued is shown in Figure 13. In spite of the marked impairment after 12 weeks on Tridione, the results were approximately normal six weeks after it was discontinued.

B. Recovery of differential brightness sensitivity at 2 millilamberts after adaptation to 2,000 millilamberts. Three patients, were given this test prior to Tridione

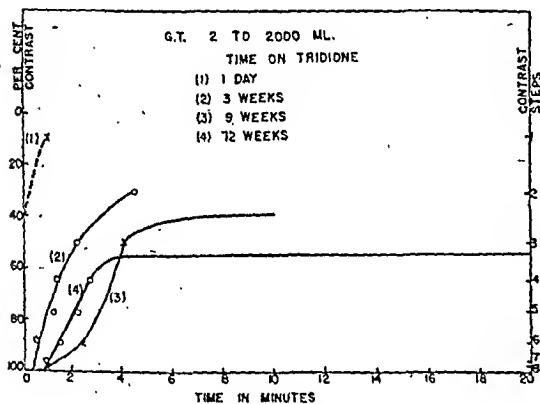


Fig. 12 (Sloan and Gilger). Changes in rate of recovery of contrast sensitivity with duration of therapy. Subject G. T.

therapy. The time required to perceive the 9-percent contrast was less than 0.3 minutes in every case. Five patients were tested at intervals while taking Tridione. Recovery curves for W. C. are shown in Figure 14 to illustrate typical results. It may be seen that while there was a significant retardation in recovery, the rates were too rapid in this test to permit an accurate determination of the course of the curves. The times required by W. C. to perceive the 9-percent contrast varied from 1.5 minutes to 2.4 minutes in the different tests. The maximum times re-

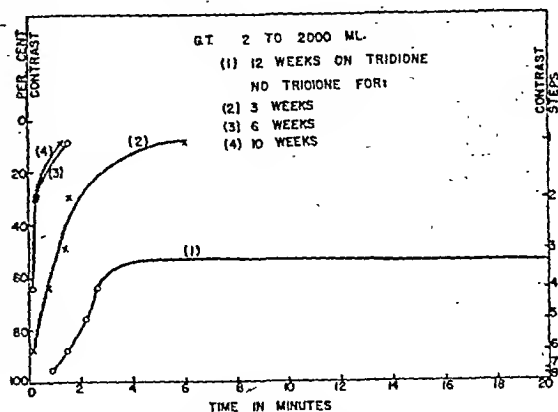


Fig. 13 (Sloan and Gilger). Improvement in recovery curves of contrast sensitivity when Tridione was discontinued. Subject G. T.

quired by each of the five patients to reach this point on the curve are listed in Figure 14. F. S. and E. W., as in previous tests, showed the least deviation from normal and required only 0.5 and 1.1 minutes, respectively, to perceive the 9-percent contrast. These times, although short, probably represent a true impairment, since prior to therapy both patients required less than 0.1 minute.

Individual differences in the rate of recovery of brightness discrimination,

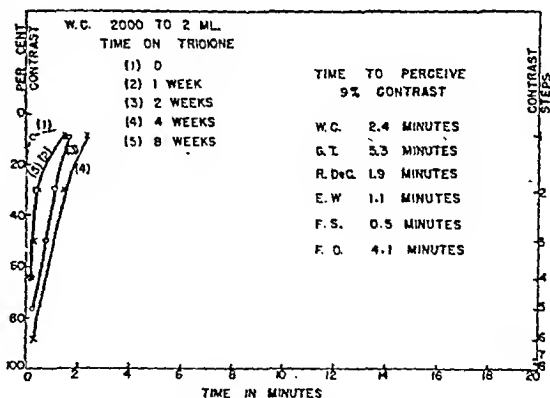


Fig. 14 (Sloan and Gilger). Rate of recovery of contrast sensitivity after change from 2,000 to 2 ml. The curves on the left show changes in rate of recovery for one patient, W. C., with duration of therapy. The tabulated data on the right give the maximum times required by different patients to perceive a 9-percent contrast. In normal subjects recovery is practically instantaneous.

with change from high to low brightness and the reverse, correspond closely to the individual differences in rate of recovery of visual acuity. The more rapid recovery of contrast sensitivity than of acuity may be attributed in part to the fact that the smallest contrast measured is greater than the minimum which can be perceived by the normal subject. Because of this, recovery of contrast sensitivity could not be followed to its maximum.

The general similarity in the results of the two types of test suggests that poor brightness discrimination rather than impaired resolving power of the retina is the primary factor responsible for the reduction in visual acuity. This is supported by the statements of the patients that they could not see the test letters immediately after increase in the illumination because everything looked white.

III. TESTS OF THE LIGHT THRESHOLD

The instrument and procedure used in these studies has been described in detail elsewhere.⁴

1. THRESHOLD OF THE DARK-ADAPTED EYE

The thresholds of the fully dark-adapted eye were measured at 19 different locations in the horizontal meridian, extending from the fovea to the far periphery both nasally and temporally. The average of these 19 thresholds, designated hereafter as the "horizontal-meridian threshold" provides a sensitive index of changes in the general level of sensitivity of the rod mechanism throughout the retina.

Three patients, E. W., F. D., and W. C. were tested before and during Tridione therapy. The horizontal-meridian threshold of E. W. before therapy was 5.32 (log micromicrolamberts); after three weeks on the drug, 5.10; after 16 weeks, 5.0. The thresholds of F. D., in four successive tests during a period of

four months prior to therapy, were 5.30, 5.22, 5.13 and 5.22; after eight weeks on Tridione, the threshold was 5.29. In these two patients the evidence is unequivocal in showing no significant increase in rod thresholds at a time when tests of visual acuity and brightness discrimination revealed marked impairment of cone function. The data for the third patient, W. C., are less satisfactory because of the greater variability in successive tests. The horizontal-meridian threshold prior to therapy was 5.43; after one week on the drug, 5.73; after two weeks, 4.92. Tests of acuity and brightness discrimination showed greater impairment of cone function after two weeks than after one week of therapy; whereas, the increase of 0.3 log unit in the rod threshold after one week was not confirmed in the test made after two weeks. It may be concluded, therefore, that in this case also, Tridione had no measurable effect on the rod thresholds of the dark-adapted eye.*

2. RATE OF DARK ADAPTATION

Tests of differential brightness discrimination, it will be remembered, showed a slight delay in rate of recovery of sensitivity at 2 ml. after adaptation to 2,000 ml. A similar delay in rate of recovery of sensitivity of the cones or the rods or of both, might therefore be expected when the brightness threshold in-

* The horizontal-meridian thresholds of these patients are all close to the upper limit of normal. The thresholds of normal individuals, corrected for size of pupil, range from 3.8 to 5.1. Without pupil correction a somewhat greater range is to be expected. It was impossible in this study to make such corrections because photoflash bulbs for photographing the pupil could not be obtained. It is possible, therefore, that small pupils account for the relatively high thresholds. Although the patients were on institution diets perhaps low in vitamin A, this factor can be ruled out in the case of F. D., since after the first light-sense test he received daily supplements of vitamin A during the entire period of the tests.

stead of the just noticeable difference in brightness is used as a measure of sensitivity.

The rate of dark adaptation at the fovea was determined for one patient, E. W., before and during Tridione. The results are shown in Figure 15. The increase in light thresholds after 3 and 16 weeks on Tridione is slight and perhaps not significant in view of the normal day to day variation in threshold measurements. It is, however, of about the magnitude that would be expected from the results of the tests of differential sensitivity for this patient. Before therapy the time required to perceive a 9-percent contrast at 2 ml. after adaptation to 2,000 ml. was less than 0.1 minute; after 10 weeks on Tridione, it was 1.1 minute. It may be seen from Figure 15 that the light threshold reached in 0.6 minute prior to therapy is reached in about 1.7 minute. The delay in reaching a given level of sensi-

shown in Figure 16. This patient shows no significant change in cone adaptation since the curve obtained during therapy lies within the range of variation observed in the control tests. In the test of differ-

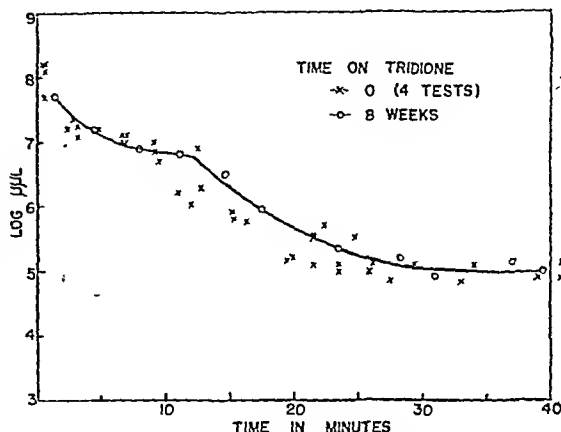


Fig. 16 (Sloan and Gilger). Rate of dark adaptation at 15 degrees in the nasal field after preadaptation to 1,100 ml. A 1-degree white test field was used. Subject F. D.

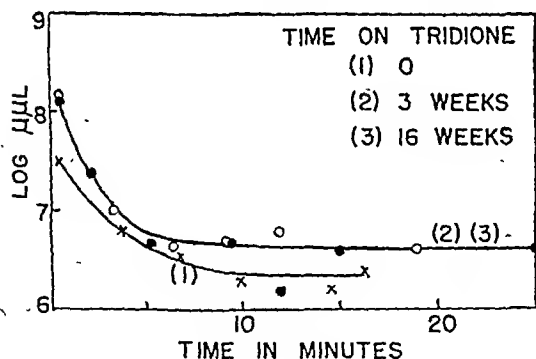


Fig. 15 (Sloan and Gilger). Rate of dark adaptation at the fovea after preadaptation to 1,100 ml. A 1-degree white test field was used. Subject E. W.

tivity is therefore about the same in the two tests.

Similar tests of the rate of dark adaptation, but at 15 degrees in the nasal field instead of at the fovea, were given to another patient, F. C. Four tests prior to Tridione and one test after 8½ weeks of therapy were made. The results are

entail brightness sensitivity given on the same day, however, he required 4.2 minutes to detect a 9-percent difference in contrast. This difference in the results of the two tests may indicate a greater impairment of the foveal than of the parafoveal cones. The second section of the adaptation curves, which measures the rate of adaptation of the rods, likewise shows no significant change with Tridione. Here, however, the variation in the data obtained prior to therapy is as much as 0.9 log unit, so that in this patient slight changes in rate of adaptation of the rods could not have been detected.

Tests of the light threshold, therefore, did not reveal any marked impairment of cones or rods, either during adaptation to darkness or after dark adaptation was complete. It is possible that the rods may show impaired function at higher intensities, such as was demonstrated in the case of the cones by other tests. Since there are no retinal areas containing rods

alone, practical difficulties arise in completely separating rod and cone function at intensities well above the rod threshold. Determinations of the variation in brightness or flicker sensitivity with variation in intensity in the scotopic range, if made before and after Tridione therapy, might however provide an answer to this problem. It is planned to make such tests in future studies.

IV. COLOR DISCRIMINATION

1. GENERAL OBSERVATIONS

The Ishihara Pseudo-isochromatic Plates, viewed in an illumination of about 20 foot-candles, were read correctly by all patients. This finding ruled out congenital red-green color deficiency and was consistent with the results of other tests showing that color discrimination is impaired only at high intensities. The visual fields for 1-degree blue and red test objects were normal when determined under standard conditions with a Brombach perimeter. When, however, a white background was substituted for the black perimeter arc and the illumination was increased from the standard value of 10 foot-candles to about 200 foot-candles, 1-degree blue and red test objects were recognized only at the fixation point. Under these experimental conditions, normal controls do not show any similar contraction of the color fields. This finding indicates that visual impairment is not limited to the foveal cones, and probably involves cone function throughout the entire retina. Further evidence of anomalous color perception is the erythropsia at high illuminations reported in the early stages of therapy by three patients. During the tests of brightness discrimination, one patient volunteered the information that the gray strips on the white background and other darker areas in the field of view appeared pink.

2. SPECIAL TEST OF COLOR VISION

Additional information as to the nature of the distortions of color perception was obtained from a special test of color discrimination similar to that used to measure brightness discrimination.

A. Apparatus. The equipment may be described briefly as follows: oblong strips (1° by $\frac{1}{2}^\circ$) of red, green, blue, and yellow are shown on backgrounds of approximately the same reflectance as the strip. Each background is a 1.6-degree square, either gray or a chromatic color differing from the test strip. The strips on their respective backgrounds are shown two at a time in an aperture in a white screen illuminated to a brightness of 2,000 ml. The brightnesses of the colors are somewhat less, the exact values depending on their reflectances. The test strips and their backgrounds were selected from standard Munsell pigment papers. In each of the four hues, strips of low, moderate, and high chroma (saturation) are used. The Munsell specifications for the 24 combinations of strip and background are listed in Table 1. These define the colors of the papers when illuminated by light of daylight quality. In illumination from photoflood lamps such as was used in most of our tests, there is probably a considerable decrease in chroma of the blues, and some increase in that of the reds.⁵

B. Results. In tests made prior to Tridione therapy, all the colored strips were identified correctly with the exception of green, which was occasionally called blue or greenish-blue particularly when on a yellow background. Of the five patients tested at a high illumination while on Tridione, all but one, F. S., showed significant abnormalities in color discrimination. The findings summarized in Table 1 illustrate the type and degree of impairment observed. The tests were given after 5 to 20 minutes' exposure to 2,000 ml. It

was not feasible to make accurate tests of changes in color discrimination with time of exposure to the high brightness because of the length of time required to present all the color combinations. It was,

were usually reported as blue, gray, or white. Calling the green strip blue may not be of significance since this error was also made prior to therapy. In Group III, the most saturated blue (chroma 12) was

TABLE-1
COLOR DISCRIMINATION IN HIGH ILLUMINATION

Group	Munsell Specifications*		Color of Strip Seen by Patients†			
	Strip	Background	G. T.	R. DeC.	F. D.	E. W.
I	R 5/12	N 5/	Yellow	Yellow	Yellow	Yellow
	R 6/6	N 6/	0	Yellow	White, later yellow	Yellow
	R 6/4	N 6/	0	Yellow	White	Yellow
	R 5/12	Y 5/6	Yellow	Yellow	Yellow	+
	R 6/6	Y 6/6	0	White	O, later white	+
	R 6/4	Y 6/4	0	White	O, later white	+
II	G 5/8	N 5/	0	+	+	+
	G 6/6	N 6/	0	+	White	+
	G 6/4	N 6/	Blue	+	White	+
	G 5/8	Y 5/6	Blue	Blue	+	+
	G 6/6	Y 6/6	White	Blue	Blue, later gray	Blue
	G 6/4	Y 6/4	White	Blue	White, later gray	Blue
	G 6/6	R 6/6	0	+	+	+
	G 6/4	R 6/4	0	+	Yellow, later gray	+
III	PB 3/12	N 3/	+	+	+	+
	PB 6/6	N 6/	0	+	White	+
	PB 6/4	N 6/	0	+	White	+
	PB 6/6	Y 6/4	White	+	White	+
	PB 6/4	Y 6/4	White	+	White	+
	PB 6/6	G 6/6	White	+	White	+
	PB 6/4	G 6/4	0	+	White	+
IV	Y 8/12	N 8/	+	+	+	+
	Y 6/6	N 6/	+	+	+	+
	Y 6/4	N 6/	+	+	+	+

* The numerator of the fraction specifies the Value (a measure of lightness). The denominator specifies the Chroma (saturation). N indicates a neutral color, that is, a gray. Neutral colors are of zero Chroma.

† + indicates a correct response; 0 indicates that no strip was seen.

nevertheless, apparent that color discrimination improved somewhat with continued exposure. The results in Table 1 represent the most marked defects observed in each patient.

In Group I, composed of red strips on gray or yellow backgrounds, the strip was sometimes not seen at all, indicating that it was a close match to the background. In other cases the strip was reported as yellow, white, or gray. In Group II, green strips on various backgrounds, the strips

always identified correctly. Blues of lower chroma were reported as white by two patients. In Group IV, yellow strips on gray backgrounds, none of the patients made any errors. In the yellowish illumination from the photoflood lamps, yellows are of higher saturation than blues of the same nominal chroma. For this reason it cannot be definitely concluded from these findings that there is a greater impairment of sensitivity to blue than to yellow. The findings do suggest, however, that

perception of red and green is more impaired than perception of blue and yellow.

V. FLICKER SENSITIVITY

Tests of sensitivity to flicker, while not directly related to the visual discriminations required in the ordinary use of the eyes, may nevertheless be of aid in explaining the visual impairment produced by Tridione. The critical flicker frequency, or rate of alternation of dark and

crimination, they may contribute both directly and indirectly to our knowledge of the effects of Tridione on vision.

1. APPARATUS FOR MEASURING CRITICAL FREQUENCY OF FLICKER

The arrangement of apparatus is shown diagrammatically in Figure 17. S_1 and S_2 are white screens, reflectance 0.88, which may be illuminated to any desired brightnesses. The square aperture, A , through which the observer views S_2 , serves as the test field; the square field, S_1 , as the surround. The test field and surround subtend visual angles of 1 degree and 10 degrees, respectively. A rotating, sectored disc, D , is located directly behind aperture, A . The closed sectors of the disc are painted a matt black (reflectance 0.06).

This apparatus differs in two ways from that usually employed⁶ in measuring critical flicker frequency (c.f.f.) in man. First, the illumination of the test field is not cut off simultaneously over its entire area. Second, the light illuminating the surround also falls on the black sectored disc. In Series A, in which the surround is matched to the test field at each intensity, the dark phase of the flickering light has a brightness about 3.5 percent of that of the light phase. In Series B and C, in which the surround is maintained at a constant low brightness of 1 ml., the dark phase is only 0.07 ml. The experimental conditions of this study are therefore somewhat similar to those frequently used in animal experiments in which moving black and white stripes provide the flicker stimulus.⁷ The findings may perhaps differ slightly from those obtained when the entire flicker field is reduced simultaneously to zero brightness. Valid comparisons are nevertheless possible between the data for normal controls and those for patients on Tridione when both are tested under identical conditions.

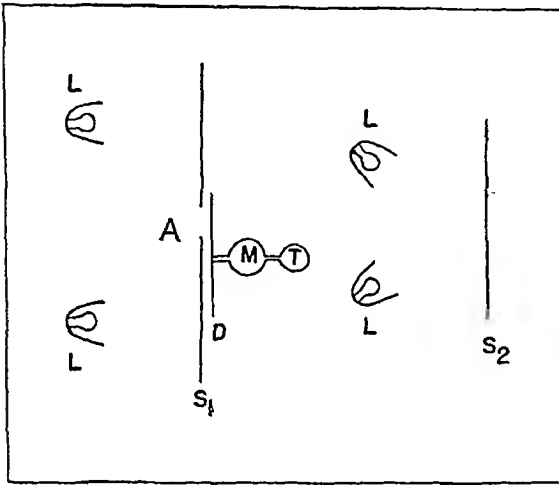


Fig. 17 (Sloan and Gilger). Arrangement of equipment for measuring critical frequency of flicker. S_1 , illuminated surround. A , 1-degree square aperture through which subject views illuminated screens, S_2 . D , sectored disc. M , motor. T , tachometer. L , lamps in reflectors.

light flashes at which the sensation of flicker disappears, has been extensively investigated under a number of experimental conditions. Such studies have been made not only in man, but also in many of the lower animals which respond with characteristic reflex movements to a flickering light. It is possible that a final explanation of the effects of Tridione on the visual mechanism may require parallel experiments on animal subjects. Since measurements of critical flicker frequency in human beings can more easily be duplicated in animal experiments than can measurements of acuity or brightness dis-

2. RESULTS

Series A. In the first series of experiments the c.f.f. in cycles per second was measured at fusion brightnesses of the test field ranging from about 1 to 1,000 ml. The flicker disc was composed of equal open and closed sectors. The fusion brightness of the test field was therefore one half the brightness of the illuminated screen S_2 . The brightness of the surround, S_1 , was matched in each case to the brightness of the test field at fusion.

Results are given in Figure 18 for four normals and three patients on Tridione. In normal subjects, the c.f.f. increased with increase in brightness of the test field up to about 300 ml. (2.5 log units), then became constant or decreased slightly. In the three patients on Tridione, the c.f.f. followed a normal course up to about

flicker sensitivity. It is of interest that, although marked impairment of sensitivity to flicker persisted after adaptation to high brightness, the visual acuity and

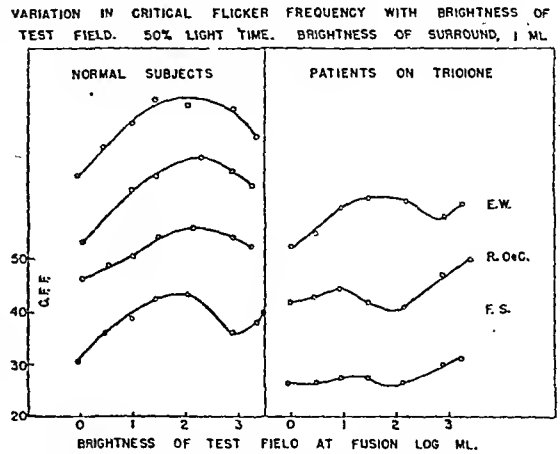


Fig. 19 (Sloan and Gilger). Variation in c.f.f. with variation in fusion brightness of the test field when the brightness of the surround is 1 ml. The curves are separated vertically as in the previous figure.

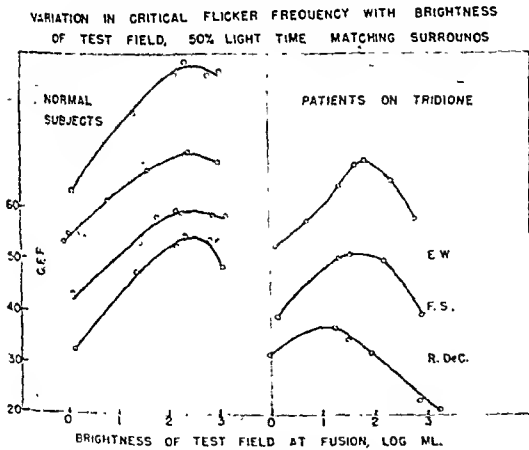


Fig. 18 (Sloan and Gilger). Variation in c.f.f. with variation in fusion brightness of the test field when the surround is of the same brightness as the test field. The lowest curve in each group is in the correct location. The others are shifted upward in steps of 10 units on the vertical ordinate.

30 ml. (1.5 log units) then decreased at higher brightnesses.

The measurements of c.f.f. charted in Figure 18 are those obtained after adaptation to each brightness for the time necessary to reach a constant level of

differential brightness sensitivity of these three patients nevertheless showed complete recovery after adequate light adaptation. In one case, R. DeC., alternate measurements of acuity and c.f.f. were made at the same high brightness until both reached constant levels. This test proved conclusively that, under identical experimental conditions, visual acuity may be normal and sensitivity to flicker markedly reduced.

Series B. In the second series of flicker experiments the brightness of the surround was maintained at a constant low value of 1 ml. The other experimental conditions were the same as in Series A. Figure 19 gives the c.f.f.-Log-I curves for four controls and three patients on Tridione. The curves of normal subjects were in general similar to those obtained by them with matching surrounds, but showed slightly lower values of c.f.f. throughout, and a more marked drop at high intensities. These differences are in

accord with the results of previous investigations.⁸

The curves of the patients on Tridione, however, differed markedly from normal. Their irregular course suggests that two opposing factors were at work, one producing a decrease, the other an increase

ml. (3.24 log units), where the c.f.f. was 39.6 when determined with a low surround, but only 20.6 when determined with a matching surround. Additional experiments indicated that the effect of the different surrounds on the c.f.f. cannot be attributed to the difference in level of light adaptation. When the eye was adapted to 1 ml., and the surrounding field was suddenly increased to match the test field, the c.f.f. dropped immediately from 39.6 to 8.0, then rose gradually to 20.6 as the eye became adapted to the higher brightness. Conversely after adaptation to the higher brightness, with sudden decrease in the brightness of the surround to 1 ml., the c.f.f. rose immediately from 20.6 to 32.5, then showed a further rise to 39.6 as the eye became adapted to the lower brightness.

It appears, therefore, that the brightness of the surrounding field has an im-

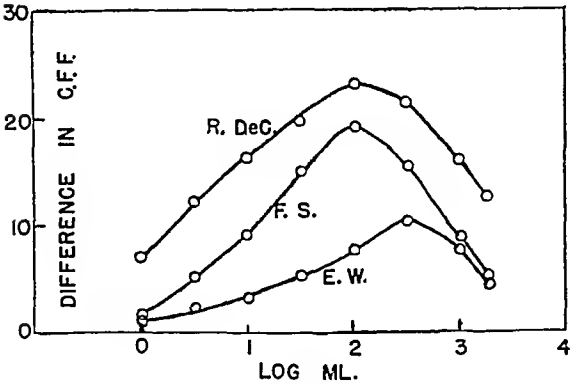


Fig. 20 (Sloan and Gilger). Difference between the values of c.f.f. for a normal subject and for each patient on Tridione. The data are obtained from the curves of Figure 19.

in c.f.f., with increase in intensity. This is more clearly evident in a graph showing, not the actual values of c.f.f. at each intensity, but the difference between these values and those of a normal subject. Such data are shown for each of the three patients in Figure 20. Impairment in flicker sensitivity, as indicated by the degree of deviation from the curve of a normal subject, increased regularly for all three patients with increase in intensity up to 2 or 2.5 log units. At still high intensities there was a gradual return toward normal. The data obtained with matching surrounds, on the contrary, showed gradually increasing impairment with increase in intensity and no evidence of recovery at high intensities. The difference in the results of the two tests is apparent in Figure 21 where both curves are shown on the same graph for one patient who was given the two tests on the same day. The most marked difference occurred at the highest intensity, 1,740

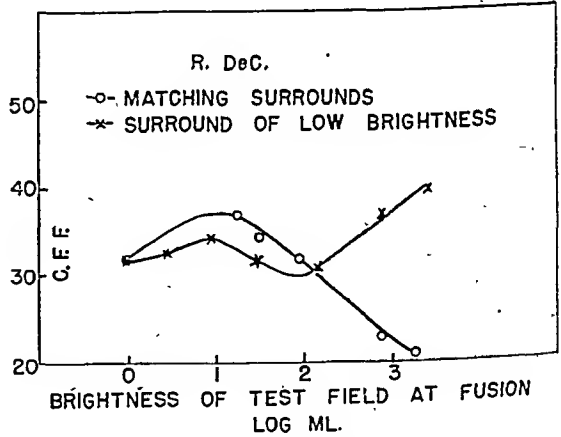


Fig. 21 (Sloan and Gilger). Comparison of the results when the brightness of the surround is maintained at a constant value of 1 ml., and when it matches the test field at each intensity. Subject R. DeC.

mediate and direct effect on sensitivity to flicker. Some process of facilitation may occur when the surround is much lower in brightness than the test field, and conversely a high brightness of surround may have an inhibitory effect on flicker discrimination. These effects, it will be

noted, are the reverse of those occurring in the normal eye. Such interaction between different retinal areas when manifested practically instantaneously cannot easily be explained in terms of photochemical changes and is, therefore, usually attributed to processes involving lateral connections in the neural layers of the retina.

Series C. In the two previous tests, the dark phase was 50 percent of the complete cycle. A third series of tests investigated the effect of variation in the relative lengths of the dark and light phases. Flicker discs with different sizes of closed sector provided dark-times of 10, 25, 50, 75 and 90 percent. Other experimental conditions were the same as in Series B.

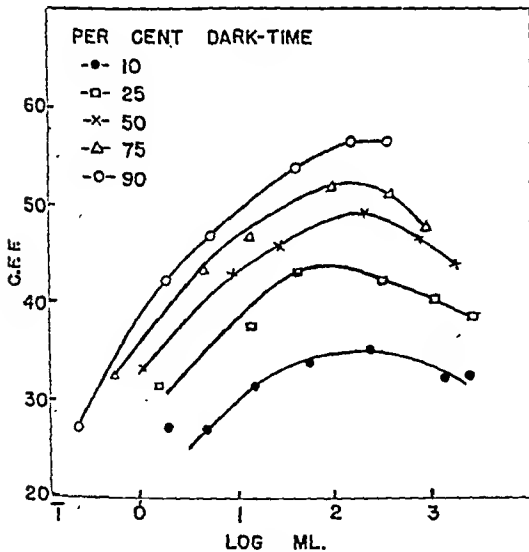


Fig. 22 (Sloan and Gilger). Variation in c.f.f. with variation in fusion brightness of test field for five different values of dark-time. Normal subject.

It has been shown in previous studies by Crozier, Ross, and others⁹ that for constant brightness of the test field, the c.f.f. increases with increase in the dark-time. Our data, both for normal subjects and patients on Tridione, are in agreement with those of Ross, who found that fusion brightness and dark-time are inde-

pendent variables whose effects on the critical frequency of flicker are additive. Data for a typical normal subject illustrating the effect on the c.f.f.-Log-I curve of change in dark-time are shown in

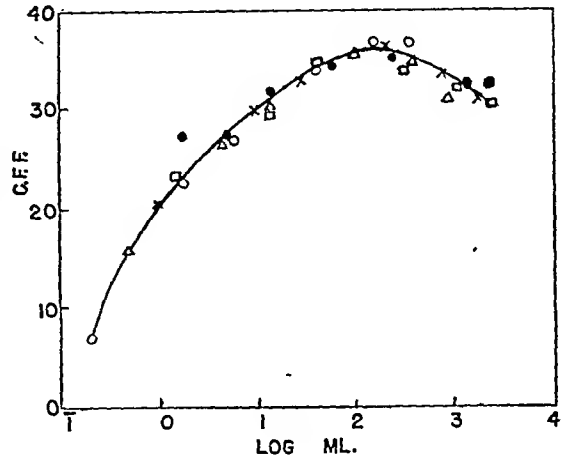


Fig. 23 (Sloan and Gilger). Replot of data of Figure 22 after applying corrections required to superimpose the data for five dark-times. The symbols have the same meaning as in Figure 22.

Figures 22 and 23. In Figure 22 it may be seen that the five curves for different dark-times follow approximately parallel courses, suggesting that increase in dark-time merely shifts the curve upward without changing its shape. In order to test this assumption the same data have been replotted in Figure 23 after applying suitably chosen corrections to compensate for the effect of increase in dark-time on the c.f.f. It may be seen from Figure 23 that it is possible to draw a single curve through the points representing the corrected values of c.f.f. for all five dark-times. The same treatment of the data of a second normal subject gave essentially similar results.

Similar tests were given to two patients on Tridione (figs. 24 and 25). Here, too, the data for different dark-times can be fitted approximately to single curve by subtracting a constant from the values of c.f.f. for each dark-time. The patients on Tridione, however, showed a smaller in-

crease in c.f.f. with increase in dark-time. Table 2 gives these data for the normal subjects and the patients on Tridione. For the two normals, the increase in c.f.f. with

reached, c.f.f. decreased with further increase in intensity. (2) When the surround was maintained at a constant low brightness and only the test field was increased in intensity, a similar decrease in c.f.f. occurred at intermediate intensities. At still higher intensities, however, the c.f.f. increased again and approached a normal value at an intensity of 3 log units or greater. Impairment in foveal sensitivity to flicker at high intensity was greatest, therefore, when a large area of

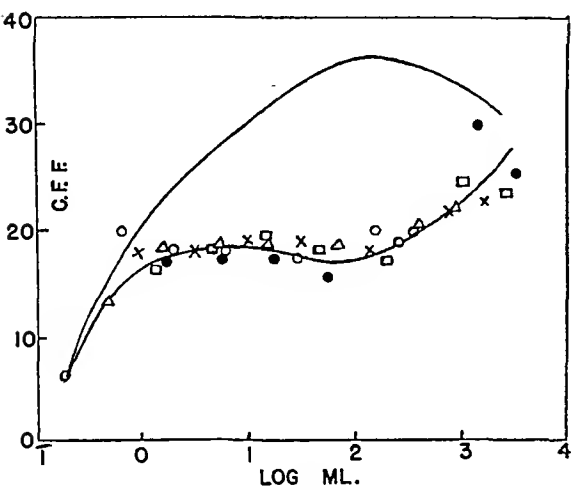


Fig. 24 (Sloan and Gilger). Superimposed data for five dark-times. Subject F. S. Symbols as in Figure 22. The normal curve from Figure 23 is shown for comparison.

increase in dark-time from 10 percent to 90 percent was 19.8 and 20.0 cycles per second. The two patients on Tridione showed increases of only 10.9 and 14.0 cycles per second. The results suggest that the rate or extent of recovery taking place during the dark phase was decreased in some way by Tridione.

The effects of Tridione on sensitivity to flicker, demonstrated in these studies, may be summarized as follows. (1) With increase in intensity of both test field and surround, c.f.f. at first increased, but more slowly than normal. When an intensity of about 300 ml. (log I-2.5) was

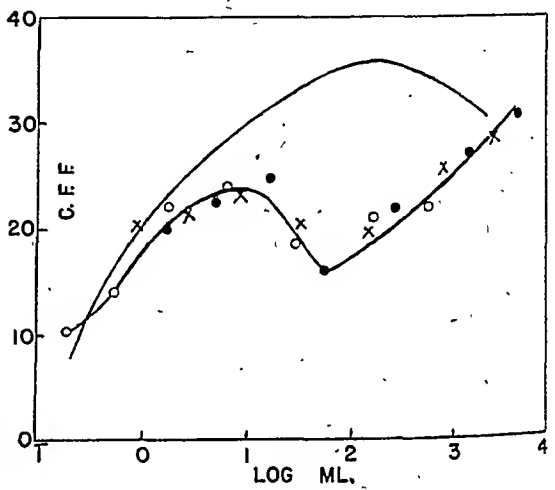


Fig. 25 (Sloan and Gilger). Superimposed data for three dark-times, 90, 50, and 10 percent. Subject R. DeC. Symbols as in Figure 22. The normal curve from Figure 23 is shown for comparison.

the surrounding retina was also exposed to the high intensity. (3) With increase in the relative length of the dark phase of the flicker cycle, the increase in c.f.f. was not as great as that observed in normal subjects. (4) The abnormalities in flicker

TABLE 2
CHANGE IN C. F. F. WITH CHANGE IN LENGTH OF DARK PHASE OF FLICKER CYCLE

Increase in Dark-Time from 10% to	Cycles Per Second			
	Normal 1	Normal 2	F. S.	R. DeC.
25%	8.2	6.1	5.5	—
50%	13.2	12.4	8.3	11.1
75%	16.5	14.3	9.3	—
90%	19.8	20.0	10.9	14.0

sensitivity observed in patients on Tridione do not appear to be closely related to the impairment in visual acuity, brightness and color discrimination observed in these patients. Flicker sensitivity may, for example, show marked impairment under experimental conditions in which visual acuity is not affected. One patient, F. S., with very marked defects in the flicker tests showed only slight impairment in the other group of tests.

VI. ADDITIONAL STUDIES

Before Tridione therapy was commenced, external, ophthalmoscopic, and slitlamp examinations were made on each patient. Most of the patients showed a faint lenticular haze and slight retinal vascular changes of an arteriosclerotic or arteriolar sclerotic nature. Other than these, no pathologic findings were present in the seven patients studied intensively. During the time which these patients were followed, there was no change in these findings except in one case where there was a definite slight increase in fine cortical opacities during the course of nine months. All the patients studied in the previous tests had corrected visual acuities of 20/20 or better in each eye, and read Jaegar 1 with correction.

Two additional patients on Tridione died from other causes, one while on therapy and the other 48 hours after it was discontinued. Because of their bedridden state, extensive studies of visual function had not been made. Sections of the posterior segments of these eyes were obtained and studied with the help of Dr. Jonas S. Friedenwald. As was anticipated, the delay in fixing the eyes due to the time required to secure the autopsy permits resulted in sufficient autolysis to mask any slight changes in the nerve cells and fibers which might have been seen with special staining techniques. No pathologic findings were present except those

diagnosed ophthalmoscopically prior to therapy with Tridione and those due to the terminal systemic disease. The eyes of one of the patients who died of uremia showed on microscopic examination: "Slight septic choroiditis; retinal arteriosclerosis." Retinal arteriosclerosis was the diagnosis made before Tridione was given. The other patient died from bronchogenic carcinoma. Ophthalmoscopy before Tridione revealed pallor of the discs, O. U., and there was no observed change during therapy. The eye-pathology diagnosis was: "Slight septic choroiditis; partial optic atrophy."

Subjective sensations of the patients while on therapy were of interest. While adapting to a high intensity of illumination, most reported that "white clouds" were passing in front of their eyes. Occasionally the clouds would roll away so that they could see better and then would close in for a short time again. Three patients complained of erythropsia in outdoor illuminations; this disappeared on continued use of the drug. Our patients found that their subjective symptoms were alleviated by wearing dark glasses in outdoor illuminations.

SUMMARY AND CONCLUSIONS

The significant effects of Tridione on visual function demonstrated in this study may be summarized as follows:

1. Acuity, brightness sensitivity, color discrimination, and sensitivity to flicker showed temporary impairment in all patients tested, when both the foveal test field and a surrounding area of 6 to 10 degrees were illuminated to a high brightness. While these findings all point toward impairment in function of the foveal cones at high brightnesses, supplementary tests indicated that the defect was not a localized central scotoma but involved cone function throughout the entire retina.

2. With continued exposure to the high brightness there was gradual improvement in visual function. In 5 of 7 patients, acuity and brightness discrimination reached normal values after about 10 minutes. Sensitivity to flicker, although it improved, continued to show significant impairment after long adaptation to the high brightness in patients who had recovered normal acuity and normal brightness sensitivity.

3. Two of the seven patients showed a lasting impairment of both acuity and brightness sensitivity at 2,000 ml. Tests of acuity at brightnesses below 2,000 ml. indicated that significant lasting impairment may extend to brightness levels of 50 ml. or less.

4. All patients showed a temporary impairment in acuity and in brightness sensitivity at 2 ml. after previous adaptation to 2,000 ml. None showed lasting impairment after adaptation to the low brightness.

5. Impairment in foveal sensitivity to flicker at high intensities was less marked when the brightness of the surrounding fields was 1 ml. and only the 1-degree test field was of high brightness.

6. Increase in the length of the dark phase of the flicker cycle produced less

than the normal increase in sensitivity to flicker at the fovea. This was true at low as well as at high brightnesses of the test field.

7. The findings in patients studied for more than three months while on Tridione indicate that tolerance to the visual side effects develops with continued medication. Patients reexamined after the drug was discontinued showed no evidence of any visual impairment after 10 weeks without Tridione.

The action of Tridione on the visual mechanism probably does not occur posterior to the chiasm, since exposure of one eye to a high brightness does not produce these effects in the unexposed eye. If the action were at the level of the optic nerve, it is unlikely that cone fibers alone would be affected. It seems probable, therefore, that the drug produces its effects at the retinal level. For the most part, the phenomena suggest that the neural layers of the retina rather than the photochemical processes are involved. Studies on animals of the effects of Tridione, using the electroretinogram, measuring the optic-nerve discharges, and so forth might, therefore, be of aid in explaining the mechanism of the visual defects.

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THE EFFECTS OF DI-ISOPROPYL FLUOROPHOSPHATE VAPOR ON THE EYE*

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The fluorophosphates have an eserine-like effect, increasing the activity of the parasympathetic system. In the eye, this is manifested in a pronounced miosis, reduction of the intraocular pressure, conjunctival hyperemia, aching of the eyeball, and mistiness of vision, the latter effect being due in all probability to increased tonus of the ciliary muscle. General effects include tightness in the chest, headache, rhinorrhea, and diarrhea.

Recent reports of the effect of diisopropyl fluorophosphate (D.F.P.) on

the eye and its use in the treatment of glaucoma have been published by Leopold and Comroe,^{1,2} and by McDonald.³ An investigation into the potentialities of D.F.P. vapor as a chemical-warfare agent was undertaken by us during 1943.* With the lifting of security regulations it was thought wise to publish it in part since it contains certain basic observations on the effects of this compound on the eye.

EXPERIMENTAL

1. *Production of the vapor concentration.* Air containing di-isopropyl fluorophosphate vapor was obtained with the constant-flow device.

Owing to the lengthy analytical procedure, no analysis of the vapor concentration was carried out immediately before exposure, as with our earlier ex-

* This work was carried out under the Physiological Section (A. Fairley, head) of the Chemical Defence Experimental Station, Porton, England (Porton Report 2592). Since these experiments were designed primarily to assess the degree of visual impairment, no observations on the reduction of intraocular pressure were made.

periments, but samples of the flow were taken after each exposure for subsequent analysis. This procedure was justified by the comparatively minor eye effects which were expected and by the high degree of predictability of the vapor concentrations from the tap settings of the instrument. Very rarely did the actual dosage differ from that intended by more than a few percent. Difficulty was encountered with the decomposition of the di-isopropyl fluorophosphate presumably through the agency of moisture and alkali from the soda-glass beads in the bubbler. Bubblers were constructed with Pyrex bodies and with phenolformaldehyde resin chips in place of the beads, and the air used in the constant-flow device was dried over calcium chloride before it entered the bubbler. The stability of the di-isopropyl fluorophosphate was greatly enhanced by this procedure and consistent values for the saturation concentration could readily be calculated from the results. At $13.2^{\circ}\text{C}.$, a saturation concentration of $3,470 \text{ mg./m}^3$, corresponding to a vapor pressure of 0.337 mm. Hg. was observed.

2. *Determination of the vapor concentration.* The concentrations of di-isopropyl fluorophosphate in the vapor were estimated using the method for fluorine determination. Good reproducibility was obtained.

3. *Exposure to the vapor.* A modified respirator face-piece, which permitted the passage of vapor over the eye while enabling the individual to breathe pure air, was employed.

Both eyes were exposed, except in a few instances where corneal and iris changes were being observed. Exposure times were kept constant at five minutes and the concentrations varied in different experiments from 8 to 50 mg./m^3 , giving dosages (Ct)* in the range 40 to 250 mg. min/m^3 .

4. *Clinical examinations.* Parasympathetic stimulation may possibly influence: (a) Pupil size; (b) visual acuity; (c) the near point of accommodation; (d) the threshold of scotopic or rod vision by virtue of the diaphragmatic action of the iris; (e) the tone of the superficial and deep vascular layers of the eye, causing conjunctival hyperemia and uveitis.

Finally, the general toxic action of di-isopropyl fluorophosphates might cause corneal changes such as edema and infiltration (f). The various factors (a) to (f) were investigated as follows:

FACTORS INVESTIGATED

(a) *Pupil size.* The individual was placed in a dimly illuminated room such as to produce a brightness of about 1.15 equivalent foot-candles on the yellowish-white walls; he was told to look at the distant wall (6 meters away) and a scale was held in front of the eye and the pupillary diameter measured. In one experiment photographic methods were also used and these will be described later.

(b) *Visual acuity.* Vision at 6 meters was measured with a Snellen chart illuminated to give a brightness of its white background of 17 foot-candles, and the lowest row of letters which could be read was noted.

(c) *Accommodation.* The near point of accommodation was determined fairly crudely by holding a meter scale perpendicular to the malar bone and instructing the individual to bring a test-type card closer and closer until the fine type was blurred; he was then told to move the card back until he could just read the type distinctly, and the distance from the malar bone to this final position was recorded.

* "Ct" is used in chemical warfare to express unit dosage. Ct denotes the concentration of the gas in milligrams per cubic meter times the period of exposure in minutes.

TABLE 1

PUPIL SIZES* OF SUBJECTS IN DIMLY LIGHTED ROOM BEFORE AND AFTER EXPOSURE TO DI-ISOPROPYL FLUOROPHOSPHATE VAPOR

Subject	Dosage	Before Exposure	1 Hr. Later	24 Hrs. Later	48 Hrs. Later	72 Hrs. Later
A	40	R 4 L 4	R 2.5 L 1	R 2 L 1.5	R 3 L 2	R 3 L 2.5
B	40	R 6 L 6	R 3 L 1.5	R 2 L 1	R 2.5 L 1	R 4 L 2.5
C	40	R 6 L 6	R 2 L 2	R 2 L 1	R 2.5 L 1.5	R 3 L 2
D	80	R 5 L 5	R 2 L 1.5	R 2.5 L 1.5	R 3 L 2	R 3 L 2
E	80	R 5 L 5	R 2.5 L 2	R 2.5 L 1.5	R 2 L 1	R 3 L 2
F	80	R 4 L 4	R 2 L 1.5	R 1 L 1	R 1 L 1	R 1 L 1
G	116	R 5 L 5		R 2 L 2	R 3 L 2	
H	116	R 5 L 5		R 2.5 L 1.5	R 3 L 1.5	
K	116	R 5 L 5		R 1.5 L 1.5	R 1.5 L 1.5	
L	158.5	R 5.5 L 5.5	R 1.5 L 1.5		R 1 L 1	R 1.5 L 1.5
M	158.5	R 5 L 5	R 1.5 L 1.5	R 2 L 2	R 2 L 2	R 2 L 2
N	191	R 4 L 3	R 1 L 1	R 1.5 L 1.5	R 1.5 L 1.5	R 2.5 L 1.5
O	191	R 3 L 3	R 1 L 1	R 1.5 L 1.5		R 1 L 1

* Diameter of pupil in mm.

The mean of three determinations on each eye separately was taken. If the individuals had any refractive error, this was corrected with appropriate lenses before the test was made.

(d) *Scotopic visual threshold.* The individual was light adapted for five minutes with a bright source of light in a dark room. The light was switched off and immediately afterward the threshold of light sense was recorded continuously for half an hour on the Craik Adaptometer.

(c) *Vascular tone.* The conjunctiva was

examined for reddening, and the fundus observed with the ophthalmoscope. In selected individuals, a slitlamp examination of the iris was made.

(f) *Corneal changes.* Selected individuals (exposed to high dosages) were examined under the slitlamp.

RESULTS

(a) *Pupil size.* (See Table 1). In general, miosis began about 10 minutes following exposure; in most cases it had reached its maximum in 24 hours, although in dosages above 116 mg. min/m³

full constriction was present one hour after exposure. The miosis usually remained constant for 48 hours after which it began to abate somewhat. In the higher dosages (above 116 mg. min./m³), there was usually no sign of relaxation of mio-

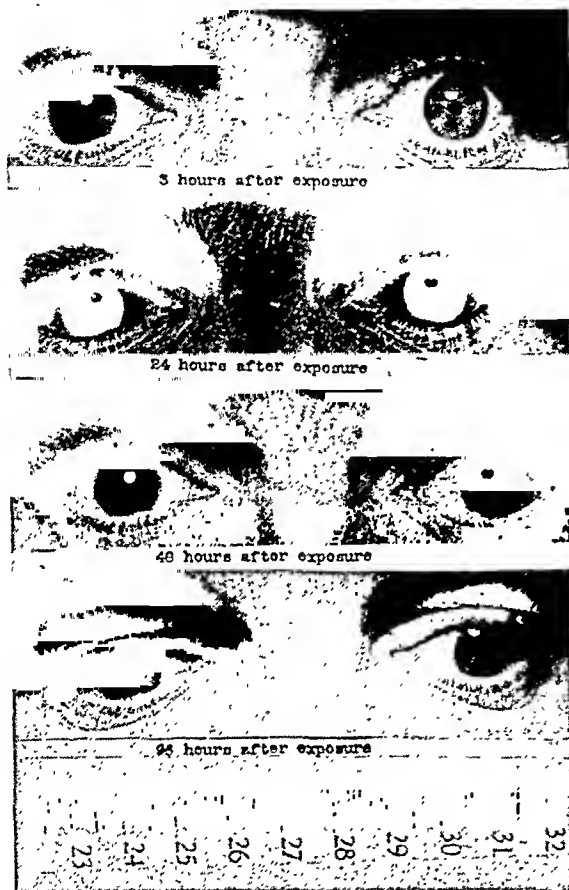


Fig. 1. (Aldrige, Davson, *et al.*). Pupil sizes after dark adaptation. Only the left eye has been exposed to D.F.P.

sis even after 72 hours. It was impossible to follow up all the subjects to ascertain how long their miosis lasted, since they were military personnel and were allowed away from their units for a few days only. However, in some preliminary experiments, it was noted that the pupils did not regain their normal size in the light for five to six days, even with moderate dosages.

The miosis following D.F.P. exposure

may be largely due to an exaggeration of the normal light reflex following the inactivation of cholinesterase; if this were true it might be expected that the miosis would relax after, say, 30 minutes to one hour in the dark. At the end of some of the dark-adaptation tests, at which time the individuals had been in the dark for some 30 minutes, an attempt was made to measure the pupils with the aid of a dim red lantern. The impression was gained that within a few hours of the exposure no relaxation of miosis occurred; whereas, after 48 hours it appeared that some increase in pupil diameter took place dur-



Fig. 2 (Aldrige, Davson, *et al.*). Subject Q. A flashlight photograph of 1/30,000-second exposure, taken 48 hours after the eye was exposed to D.F.P. The eye, dark adapted for 10 minutes, shows miosis and engorgement of the conjunctival blood vessels. Only the left eye was exposed to D.F.P.

ing dark adaptation. A more accurate experiment was carried out as follows:

The left eyes only of three men were exposed to a dosage of 100 mg. min./m³, and two hours later they were kept in a dark room for one hour; their eyes were then photographed in the dark by flashlight of 1/30,000-second duration. The same procedure of dark adaptation and flashlight photography was repeated 24, 48, and 96 hours later. The results are shown in Figure 1.

There is no doubt that the miosis can be pronounced, even after one hour's dark adaptation, and that it persists to some extent for as long as 96 hours after exposure with, however, a progressive relaxation from day to day. The persistence of the miosis for one hour in the

TABLE 2

VISUAL ACUITIES* OF SUBJECTS IN BRIGHT LIGHT BEFORE AND AFTER
EXPOSURE TO DI-ISOPROPYL FLUOROPHOSPHATE VAPOR

Subject	Dosage	Before Exposure	1 Hr. Later	24 Hrs. Later	48 Hrs. Later	72 Hrs. Later
A	40	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4
B	40	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4
C	40	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4
D	80	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/5 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4
E	80	O.D. 6/12 O.S. 6/4	O.D. 6/12 O.S. 6/6	O.D. 6/12 O.S. 6/5	O.D. 6/12 O.S. 6/6	O.D. 6/12 O.S. 6/9
F	80	O.D. 6/4 O.S. 6/5	O.D. 6/4 O.S. 6/5	O.D. 6/4 O.S. 6/5	O.D. 6/4 O.S. 6/5	O.D. 6/4 O.S. 6/5
G	116	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	
H	116	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	
K	116	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/5	O.D. 6/4 O.S. 6/4	
L	158.5	O.D. 6/9 O.S. 6/9	O.D. 6/5 O.S. 6/5	O.D. 6/6 O.S. 6/6	O.D. 6/6 O.S. 6/6	
M	158.5	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4	O.D. 6/4 O.S. 6/4
N	191	O.D. 6/36 O.S. 6/12	O.D. 6/36 O.S. 6/12	O.D. 6/36 O.S. 6/12	O.D. 6/36 O.S. 6/12	
O	191	O.D. 6/36 O.S. 6/6	O.D. 6/36 O.S. 6/6	O.D. 6/36 O.S. 6/6	O.D. 6/36 O.S. 6/6	
P†	250	O.D. 6/9 O.S. 6/12	O.S. 6/12	O.S. 6/12	O.S. 6/12	
Q†	250	O.D. 6/5 O.S. 6/4-1	O.S. 6/4-3	O.S. 6/4-3	O.S. 6/5	
R†	250	O.D. O.S. 6/6	O.S. 6/6	O.S. 6/6	O.S. 6/9	

* Visual acuity (corrected).

† O.S. only exposed.

complete absence of light stimuli tends to confirm the belief, generally held, that the pupil size is normally controlled by a balance between tonic constrictor and dilator impulses; the potentiation of the tonic-constrictor impulses by the eserine-like action of di-isopropyl fluorophos-

phate is sufficient to maintain a pronounced miosis even in the absence of light stimuli.

(b) *Visual acuity.* (See Table 2). There was practically no impairment of visual acuity among the 16 subjects used for this test.

(c) *Accommodation.* (See Table 3). The effects of dosages of D.F.P. ranging from 40 to 191 mg. min./m³ on the position of the near-point of accommodation were noted. It was found the near-point moved inward a few centimeters in all cases, a finding which suggests that there is an increased development of tension in the ciliary muscle during accommodation; the absence of any serious impairment of distance vision, however, indicates that there is no uncontrollable spasm of this muscle with the concentrations employed.

(d) *Scotopic visual threshold.* (See Table 4). The threshold brightness required to stimulate the light sense of dark-adapted individuals before and after exposure to D.F.P. was recorded. In all cases the threshold increased one to two

hours after exposure, and later tended to return to normal. If the pupil size before exposure were 6 mm. and after exposure 1.5 mm. in diameter, the amounts of light entering the eye in the two conditions would be in the ratio of about 16 to 1 and one would expect the thresholds to be raised in this proportion. In actual fact so large an increase was never found, the maximum effect being a tenfold rise. The effects of instillation of two drops of 0.5-percent eserine and of 1.2-percent homatropine hydrobromide on threshold brightness were then studied, it being found that eserine has a comparable effect with that of D.F.P. On the other hand a slight reduction in the visual threshold occurred with homatropine as would be expected with a dilated pupil.

(e) *Vascular tone.* (See Figure 2).

TABLE 3
EFFECT OF DI-ISOPROPYL FLUOROPHOSPHATE VAPOR ON THE
NEAR-POINT* OF ACCOMMODATION

Subject	Dosage	Before Exposure	1 Hr. Later	24 Hrs. Later	48 Hrs. Later	72 Hrs. Later
A	40	R 19.5 L 19.5		R 16 L 13.5	R 15 L 18.5	R 17.5 L 16.5
B	40	R 12.5 L 13		R 11.5 L 7.5	R 9.5 L 8	R 12.5 L 14
C	40	R 15. L 14.5		R 13 L 13	R 13.5 L 12	R 15 L 12
D	80	R 21 L 21		R 16 R 12	R 18.5 L 13	R 17.5 L 12
E	80	R 12 L 12		R 6.5 L 6	R 7 L 6	R 7.5 L 6
F	80	R 11 L 10		R 9 L 10	R 11 L 9	R 9.5 L 8
L	158.5	R 16 L 14	R 9.5 L 10	R 9.5 L 10		R 13 L 13
M	158.5	R 17 L 16.5	R 15 L 12.5	R 12 L 11	R 12 L 11	R 12 L 11.5
N	191	R L 17.5	R L 15	R L 13.5	R L 17.5	
O	191	R L 16	R L 14.5	L 14	L 17	

* Near-point of accommodation in cm.

TABLE 4

VISUAL THRESHOLDS* OF DARK-ADAPTED SUBJECTS BEFORE AND AFTER EXPOSURE TO DI-ISOPROPYL-FLUOROPHOSPHATE AND CERTAIN DRUGS

Subject	Dosage mg. min./m. ³	Before Exposure	1-2 Hr. After	24 Hrs. After	48 Hrs. After	72 Hrs. After
K	116	0.8	8.0		2.5	
H	116	2.0	7.0		3.0	
G	116	0.8	4.0	0.9		0.4
L	159	0.3	0.9	5.0	2.0	1.0
N	191	0.5	1.0	1.0	1.0	
O	191	1.0	8.0	8.0	5.0	
S	Eserine	1.5	10.0	1.0		
T	Eserine	0.9	3.5	2.5		
G	Eserine	0.4	1.5			
U	Homatropine	0.9	0.8	0.7		

* Threshold brightness in equivalent foot-candles. $\times 10^5$.

Subjects exposed to dosages of 100 mg. min./m.³ and above generally showed hyperemia of the conjunctival vessels, the sign appearing some 48 to 72 hours after exposure with dosages up to 191 mg. min./m.³ (although in one case it appeared within 24 hours). With a dosage of 250 mg. min./m.³, the hyperemia was much more severe and was manifest within 24 hours of exposure. With this dosage, a marked congestive iritis developed in three of the volunteers, as evidenced by the presence of dilated iris vessels, and cells in the anterior chamber. This was present for one day only, and responded to instillations of homatropine.

The marked miosis of subjects exposed to D.F.P. vapor precluded a careful ophthalmoscopic study, except in the instances where the miosis was abolished with a mydriatic. No changes were noted.

(f) *Corneal changes.* No changes were observed under the slitlamp even with the highest dosages.

(g) *Subjective symptoms.* The subjective symptoms volunteered by the indi-

viduals exposed to the higher concentrations of vapor consisted in mistiness of vision, aching of the eyeballs, and difficulty in seeing in dim light. The symptoms began to clear up on the third day following exposure.

DISCUSSION

The results described in the earlier sections of this report speak for themselves. Several points emerging from this work will, however, bear comment. The most dangerous effect of D.F.P. vapor on the eye is clearly the congestive iritis caused by dosages of 250 mg. min./m.³. Associated with the iris changes was a marked conjunctival hyperemia, both signs appearing some 24 hours after the exposure. With more moderate dosages of 100 to 200 mg. min./m.³, conjunctival signs only were observed, and these appeared, with one exception, 48 hours after exposure. The cause of these delays is not easy to find—it may be that the continued accretion of unhydrolysed acetylcholine eventually causes sufficient stimulation of cholinergic dilator fibers to overcome the

normal constrictor tone of the eye vessels, but this is mere speculation.

The effects of the vapor on the accommodative apparatus were slight, suggesting merely the development of a greater than normal tension in the ciliary muscle during accommodation.

As one would expect, the diaphragm

effect of the miosis causes a rise in the threshold of night vision, similar in magnitude to the effects described in the literature.

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SOME METHODS OF LID REPAIR AND RECONSTRUCTION

IV. TOTAL RECONSTRUCTION OF THE UPPER LID*

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Trauma which destroys the entire upper lid and leaves the lower lid intact is a rare phenomenon. Spaeth¹ has labeled this type of case "the accident of an accident" and states, "No case has ever presented itself to the author in which the upper lid was alone involved and completely destroyed." This report is of interest, therefore, because it concerns just such an injury.

CASE REPORT

T. B. was wounded on April 13, 1945, while fighting in northern Luzon. He sustained a penetrating wound of the right upper lid and the right eyeball, fractures of the right orbital bones, and a laceration of the right frontal lobe of the brain. The following day the eye was enucleated, the upper part of the orbit exenterated

and the brain wound debrided. Recovery was uneventful, and the patient was returned to this country for further plastic surgery.

On admission to the hospital here, examination showed the upper lid to be completely absent. The whole socket except for the palpebral portion of the lower lid near the margin was lined with granulation tissue. The lower lid was intact but entropic. By some trick of fate the caruncle was spared. This was a welcome windfall as the final cosmetic result is always better when the caruncle is present (fig. 1). The repair was made as follows:

First Stage. A pedicle flap (1.5 cm. wide and 8 cm. long) was raised from the skin of the right forehead with the lower 4 mm. including the hair of the brow (fig. 2a). This was delayed for two weeks. Fourteen days later the skin edges around the upper orbit were freshened and the granulation tissue covering the

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upper half of the socket carefully scraped away. The skin of the naso-orbital angle was undermined and mobilized. The pedicle flap from the brow was raised again, rotated down, and sutured above



Fig. 1 (Fox). Condition before operation showing total loss of the right upper lid. Socket is lined with granulation tissue. Note entropion of right lower lid and sparing of caruncle.

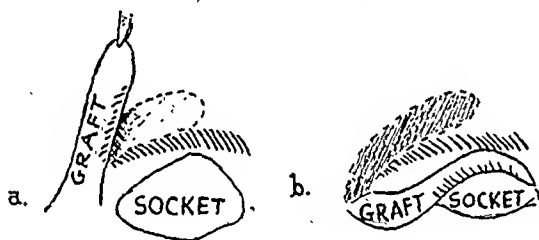


Fig. 2 (Fox). Diagram of procedure in first stage of repair. (a) A pedicle graft is raised from the forehead to include hair of brow at lower margin for the cilia line of the reconstructed lid. (b) After a delay of 14 days, the pedicle is raised again, rotated down, and sutured to the freshened skin edge below the brow.

and medially to the skin below the brow with interrupted sutures of 4-0 braided black silk (fig. 2b). The wound above the brow was closed with 4-0 plain catgut, subcuticular, and 4-0 black-silk skin sutures. The socket was stuffed with vaseline gauze and the graft pressed against the upper posterior socket wall to insure adequate blood supply. A firm supportive dressing with bandage was applied. The graft "took" well and the sutures were



Fig. 3 (Fox). Ten days later, before removal of the sutures. The graft has taken well.

removed on the 10th day after operation (fig. 3).

Second Stage. Six weeks later the graft, now obviously healthy and viable, was dissected away from the socket wall, and the socket itself was lined with a split skin graft taken from the inner aspect of the right arm. The method used here was described in a previous report published in the JOURNAL.² Figure 4 shows the reconstructed socket with a conformer in place.

Third Stage. Five weeks later the scar below the brow was excised and subcutaneous tissue resected to thin out the lid and give it a more normal appearance. (It should be remembered that brow skin is thicker than the skin of a normal lid). At the same time a free graft was taken from the left upper lid and planted in the bed thus prepared for it in the recon-

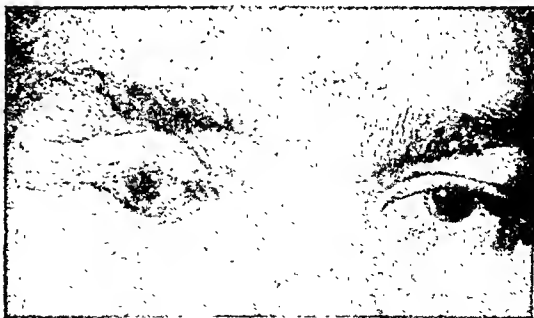


Fig. 4 (Fox). The graft is dissected away from the socket wall, and the socket is lined with a split skin graft. Conformer in place.

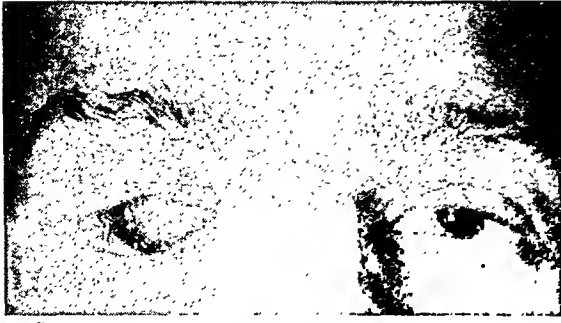


Fig. 5 (Fox). Lid graft is thinned out, and the free skin graft from the left upper lid is added to the right upper lid to widen it and to bring lid edge down parallel with lid of the other eye.

structed right lid. In this way the lid was widened and its edge brought down to approximately the same level as the left upper lid (fig. 5).

Five weeks later the entropion of the lower lid was corrected by exposing the tarso-orbital fascia and external canthal ligament and incising them sufficiently in the lower orbital quadrant to cause relaxation of the lid. This corrected the entropion too well (fig. 6) and subsequent tightening of the relaxed lower lid appeared necessary.

DISCUSSION

Many methods of repair are open to the surgeon in a case of this sort. These include, among others, the use of a tubed graft from the neck, rotated pedicles from the temple, cheek, and lower lid, and multiple free grafts of skin and cartilage. It is believed, however, that the method chosen here is the simplest available for a complicated case, for the following reasons:

1. There is comparatively little scarring as a result of the surgery, since most of the donor site is buried in the hair of the brow. For cosmetic reasons it is always best to have scars running parallel with the orbital margin whenever possible; a tubed graft or temporal pedicle would therefore have been more conspicuous.

2. The blood supply, and therefore the viability of the graft, is more certain with a pedicle than with a free graft, especially if delayed.

3. Since brow skin is at least as thick as the whole lid, the single layer was enough. Indeed, this single layer had to be thinned out to make the repaired lid conform to the other upper lid.

4. In a case of this sort there is no question of restoring function because there has been too much destruction. The reconstructed lid is immobile no matter what method is used. The aim of surgery here can only be cosmetic restoration, and the result is just about as good (or bad) as can be obtained with any other technique.

5. Because it is the simplest procedure technically, it is preferable.

In cases in which there is so much destruction, the question always arises as to whether the result is worth the effort. Some surgeons of long experience, whose opinions are valuable, feel that total lid reconstructions are never justified, because the patient is so often dissatisfied with the final result. Certainly patients should be warned before operation that one cannot reconstruct a complete lid to match the normal lid in every respect. One



Fig. 6 (Fox). Prosthesis in place after correction of entropion of right lower lid. "Stary" appearance is due to the sclera showing between the lower lid and limbus. This requires further correction.

must expect and be satisfied with a good deal less than perfection. If one succeeds in reconstructing a lid which is presentable and not conspicuous, the result is adequate.

In this case, lid and socket reconstruction made retention of a prosthesis possible and the patient was not condemned to wearing a patch for the rest of his life. The lid, although far from perfect, was sufficiently presentable so that the patient

was content and did not clamor for more surgery. He was even reluctant to have the lower lid pulled up for fear of "spoiling" the result.

SUMMARY

A method of total upper lid reconstruction by the combined use of a rotated pedicle and free graft is presented.

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TECHNICAL METHODS FOR THE 1/2,000 FIELD*

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The study of the central field on the tangent screen is of great importance in ophthalmology and neurology. In those conditions where the field changes are marked, they are easily elicited with large visual angles and the technique is not very complicated. Thus, in marked papilledema the enlargement of the blind spot may easily be mapped out with a 10-mm. white test object at two meters. Also in cases of complete hemianopia, where the scotomatous areas are very dense, sufficient information may be elicited even by confrontation. However, in working with a large neurologic and neurosurgical staff one sees many cases with either minimal or questionable visual-field changes.

In such cases, more accurate information can be obtained by using a very small visual angle, such as the 1-mm. white test

object at 2,000 mm. The visual angle subtended by this combination is 1.72 minutes and is one of the smallest visual angles that is still compatible with practical clinical use. Because of the small size of this angle, this test must be reserved for patients with good enough vision to see the test object in a reasonably fair-sized portion of the field.

This small visual angle is especially useful in diagnosing cases of early lesions in which the 5/330 or 1/330 fields will show little or no defect. In such cases, the 1/2,000 test will bring out minimal changes. Thus, in early chiasmal interference, one may get a definite upper temporal slant with a 1/2,000 test, and little to no change with the 1/330 test on the perimeter. Many such cases are illustrated by Traquair.¹ In order to demonstrate this point, two cases have been selected from the neurosurgical service of Montefiore Hospital.

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CASE REPORTS

Figure 1A shows the visual fields in a case of pituitary adenoma with chiasmal interference. The right eye shows only a slight peripheral, relative defect, temporally, for 1/330 white. The 1/2,000 test, however, shows almost complete loss of the upper temporal quadrant and beginning loss of the lower temporal quadrant.

Figure 1B demonstrates a case where the peripheral fields for 2/330 were normal, while the 1/2,000 test showed a definite bitemporal hemianopia. The latter case had very dense bitemporal, paracen-

tral scotomas preoperatively and a reduction in vision in the right eye to 6/200. X-ray studies showed an enlarged sella turcica. One week after the removal of a craniopharyngioma by Dr. Davidoff, vision returned to 20/20. At this time the peripheral field for 2/330 white was normal in both eyes while the 1/2,000 test still brought out the bitemporal defect (fig. 1B).

In some cases, the actual existence of a tumor was suggested by using a small visual angle when it was missed with a larger one. To quote Traquair, "In clinical work, the examination with 1/2,000

white is one of the most important tests and is indispensable. To omit the 1/2,000 white test is comparable to examining the central vision with a chart which has no line below 6/12ths."¹

Therefore, the study of the visual field with the 1-mm. white at 2,000 mm. is important in bringing out early or minimal defects in the visual pathways. However, the use of this small visual angle presents many technical difficulties, some of which will now be discussed.

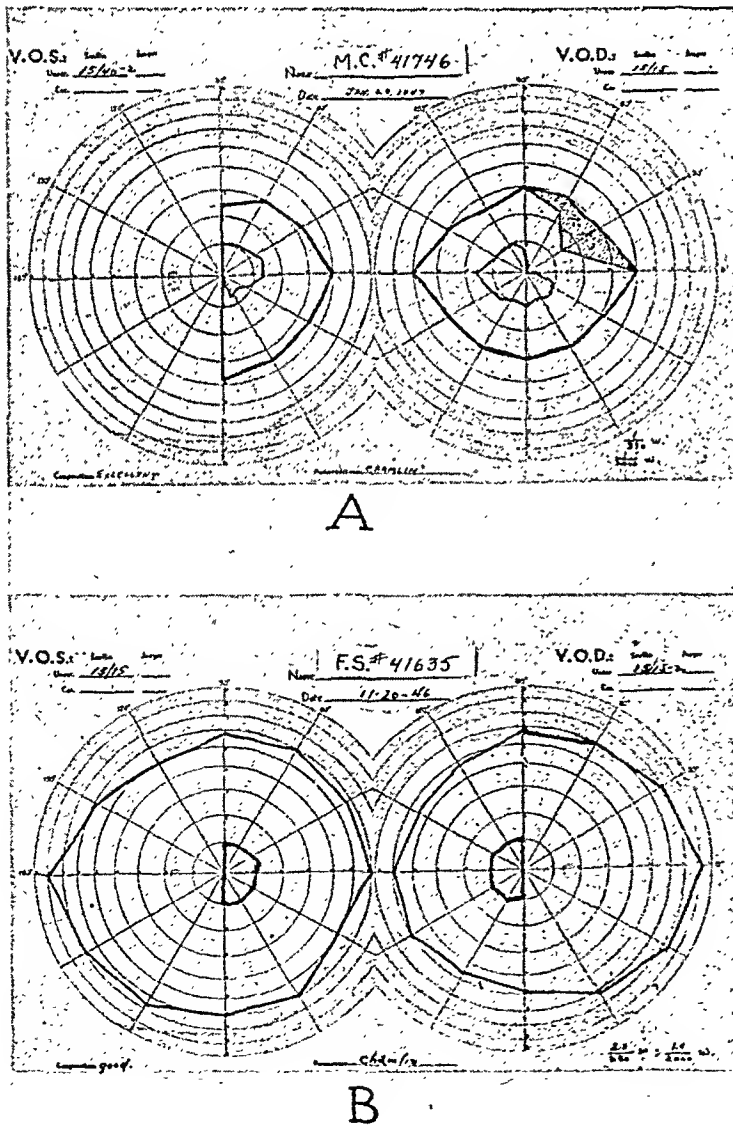


Fig. 1 (Chamlin). (A) Case of pituitary adenoma. Right field for 1/330 white shows only relative defect in upper temporal field, while 1/2,000 test shows almost complete loss of upper temporal quadrant and beginning loss of lower temporal quadrant. (B) Case of craniopharyngioma one week after removal. The fields for 2/330 white show no changes but the fields for 1/2,000 white show a very sharply defined bitemporal hemianopia.

TECHNICAL DIFFICULTIES

PATIENT

One must be careful in selecting the proper type of patient for this test. It is easiest to do this test if the patient has good visual acuity and becomes more difficult with impairment of central vision. The patient must show evidence of understanding the test fully. Certainly, a patient whose mentality is dulled by intracranial lesions or preoperative medication is not fit for this test. He must be intelligent enough and dependable enough to distinguish the small white-headed target from any distraction and he must understand fully the need for constant fixation. It takes but a fleeting, almost imperceptible shift of the eye to look at the moving test object instead of the fixation point, thereby giving erroneous readings.

TECHNIQUE

Before starting the test, the test object and carrier are shown to the patient at close range, and it is explained to him that he must recognize the test object and not the adjacent parts of the carrier. The shaft of the Berens pin or the wire of the Evans bead must be pointed out to the patient so that he does not confuse them with the tiny test object.

The patient is made comfortable with a head and chin rest and one eye is carefully covered. The head and chin rest should be adjusted to the level of the patient's face so that he will not have to bend his head forward or backward. Excess inclination of this nature may give erroneous readings in the upper and lower fields. The patient should wear his distance correction, especially when visual acuity is poor without it. With glasses, care must be taken that neither the frame nor bifocal segment interferes with the field. If necessary, the lenses may be replaced with a large trial-case frame and lens.

It is best to start by using a large test object, such as 10 mm., then 3 mm., and finally 1 mm. In this way, one gradually teaches the patient the general idea of the test. Before recording the readings with the 1-mm. test object, it is well to take several practice readings. Several constant readings must be obtained in a single meridian before considering the patient's responses as reliable.

The field is explored along each of the various meridians. At Montefiore Hospital, the 2-m. screen is marked off in 22.5-degree meridians. The test object is moved toward the center along each of these meridians. The movement should be steady and not too slow. However, it must be slow enough so that the examiner can stop within about $\frac{1}{2}$ cm. from the point where the patient calls the test object as visible. Moving more rapidly may lead to errors. On the other hand, if the movement is much slower, nonexistent scotomas may be falsely recorded. This is so, because a small stimulus such as this one, when viewed indirectly in the periphery of a field for a short period of time, will disappear from view unless it is moved continually so as to stimulate fresh retinal receptor units.² Thus, if we move very slowly, the patient may say "I see it, but now it seems to be gone." Of course, one must be careful to differentiate such errors in technique from true scotomas. The area should again be explored with slightly faster motion, and the patient must tell whether or not the white object disappeared for a short distance.

There is no need for using any zigzag motion. This type of motion is unscientific in a test such as this one and in general perimetry, as well. The zigzagging gives the over-all effect of a larger test object and subtends, therefore, a larger visual angle. Such an error would give a larger field and nullify the accuracy of this test. Furthermore, in zigzagging, the

exact point at which the patient sights the object becomes less definite and, therefore, the findings are less exact.

The black-headed pins are used to mark the points at which the white object is seen. The pins are all dipped in flat black paint to avoid bright highlights. A better method of recording is to dictate to a recording secretary the readings for the various meridians and thus avoid the use of the pins entirely. If any peripheral indentations are mapped out, these abnormal readings must be checked. Furthermore, the immediate surrounding field should be explored so that one or two intermediate readings are made between the 22.5-degree markings. If a small peripheral contracture does not depend on a single reading, the interpretation will be more dependable.

TEST OBJECTS

A spherical test object has been found more satisfactory than a flat one. The visual angle is so small, and consequently taxes the patient's peripheral vision to such an extent, that a flat test object, if only slightly tilted, would introduce a large error. The test object must be clean and perfectly white. Since the Berens test objects are easily washable, they are satisfactory in this respect. However, the shaft of the pin has a thin, smooth layer of dark paint and, if the test object is used on a carrier that exposes this shaft, a brilliant highlight is thrown off which makes it quite difficult for the patient to distinguish the shaft from the tiny white bead in the peripheral field at 2,000 mm. When the shaft of the Berens pin is exposed, it is best to cover it with a coat of flat black paint, such as is used in photography. Apply the paint in a thick and irregular layer so that the surface will reflect less light.

TEST-OBJECT CARRIERS

The test-object carriers provided with a Berens set are two in number and are made of metal rods about 3 mm. in diameter. The many test objects are interchangeable. The end of the rod is rounded and contains a groove into which the shaft of the pin fits. The test-object carrier has a highly reflecting surface, thus giving an attractive highlight, particularly at the carrying end of the rod. This highlight is very distracting. In addition, the constant changing of test objects mars the paint and exposes the shiny metallic surface underneath which, of course, makes the carrier useless until repainted. When using these carriers, I cover them with the same kind of flat black paint I use on the pin shaft. If 3-mm. or 5-mm. test objects are being used, these difficulties are less important, but with a 1-mm. test object, they are of great significance. No matter how carefully the metal carriers are painted, they still give a more distinct reflection of light than a painted wooden surface of similar size and shape.

Another difficulty arises in a busy perimetry laboratory where one uses only one or two carriers with several different sizes of test objects. The holder and the shaft of the pin lose their paint rapidly and need frequent replacement. Even if the paint does not come off, the finish becomes undesirably shiny from constant handling. Then, too, when put to constant use, the small white head is easily broken off and is frequently soiled.

For these reasons I use test objects which are permanently mounted in separate carriers made of wooden carpenters' dowels about 3 mm. in diameter. These dowels are very inexpensive and come in lengths of 3 or 4 feet. Each dowel can be broken down into 3 or 4 carriers about 12 inches in length. Since they are thin and flexible, a vibratory motion is trans-

mitted to the test object if they are longer than 12 inches. The vibration is minimized, if one touches the tangent screen with the test object, but this is undesirable because the test object will be soiled, and the tiny bead can easily become enmeshed in the superficial fibers of the flannel.

The dowels are dipped into flat black paint. The shaft of the Berens pin is repainted and is then inserted into one end of the painted wooden dowel. To insert the pin, grasp the shaft with a hemostat near its point and force it into the center at one end of the wooden dowel, sinking it 3 mm. into the wood. If it is sunk less deeply, it may fall out. If it is forced farther into the dowel, the wood is apt to split.

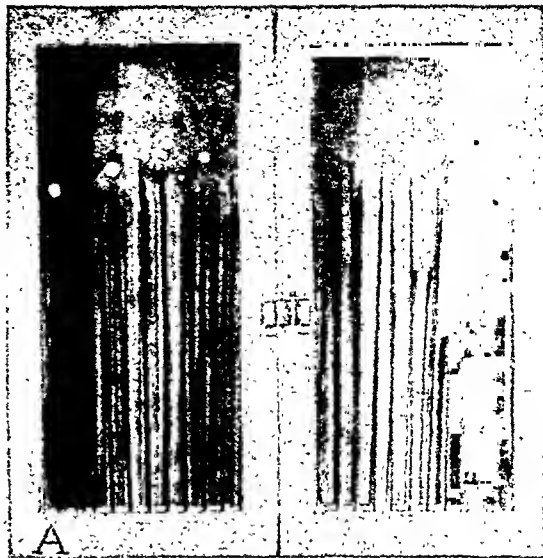
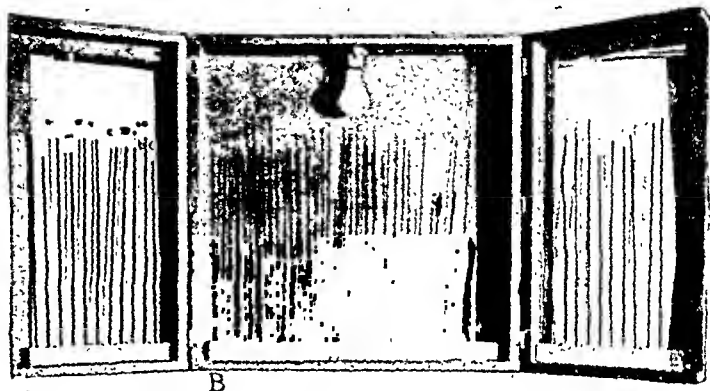


Fig. 2A (Chamlin). Wooden cabinet with glass doors shown closed and attached to wall.

Fig. 2B (Chamlin). Same cabinet as in Figure 2A with doors opened wide showing test-object carriers individually placed and standing upright in the holes in the wooden blocks fastened to bottom of cabinet and its doors. The switch to the light in the cabinet is underneath the box.



After this test object has been attached to its permanent carrier, we try not to touch it or the adjacent parts of the carrier again. A photograph of such a carrier with the 1-mm test object on the Berens pin is shown in Figure 3D. If the pin-head should need cleaning, it can easily be washed with a tiny wet swab and wiped with a dry one.

A 3-mm. dowel is suitable for test objects up to 5 mm. but it is too thin to carry the weight of heavier test objects. When the objects are 10 mm. or more, employ a 6-mm. dowel. (The width of the carrier is no longer as important as it is with the smaller test objects.) These heavier

dowels and pin shafts are painted in the same way as the lighter ones, although the finish no longer plays the distracting role that it did with the 1-mm test object.

Heavier test objects are permanently fastened to individual wooden handles to avoid repeated handling of the test object, the pin shaft, and the carrier. By reducing handling, breakage and soiling are minimized.

All of these test objects permanently affixed to their carriers, are kept in a glass-enclosed wall cabinet (fig. 2A). Along the bottom of this cabinet, which is 6-inch deep, there is a block of wood with small holes bored in it, slightly wider than

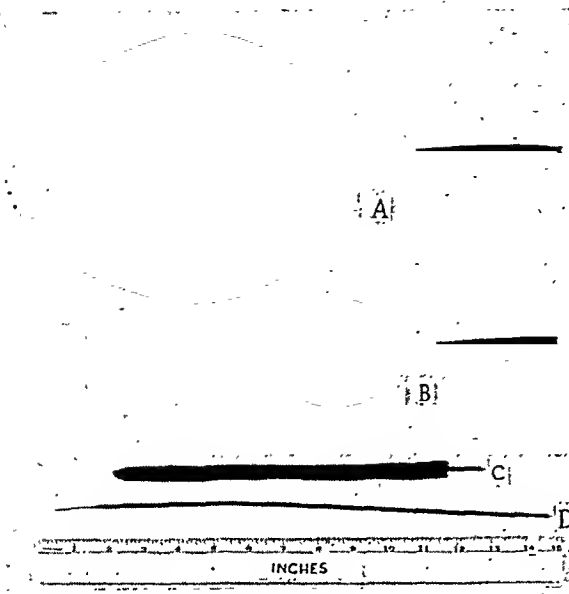


Fig. 3 (Chamlin). (A) Large flannel-covered test-object carrier with 1-mm. test object. (B) Similar test-object carrier but much smaller for use with perimeter. (C) Flannel-covered steel carrier with white test object welded to steel. This is a 2.5-mm. test object. (D) Wooden dowel with Berens pin attached, dowel and shaft of pin being painted matt black. Test object is 1.0-mm. white.

(*Author's note.* Due to the tiny size of the 1-mm. test object, it is not visible in the above photograph. The 1-mm. test object is found in approximately the center of each of the paddle-shaped carriers A and B, also at the end of the shaft of the pin in D. The larger white test object at the end of carrier C is just about visible.)

the diameter of the dowels and 1-inch apart. All the carriers are inserted in this wooden block, with the test objects upward. The two doors closing off the front of the cabinet have a deep frame with a similar block of wood along their lower borders. Thus, when both doors of the cabinet are open (fig. 2B), the entire set of test objects can be checked at a glance, and any one of them can be removed or replaced with ease and without unnecessary handling.

In addition to making the test objects more lasting, the individual handles permit one to use them in rapid succession. For instance, in studying central fields, I frequently use the 1-mm. white, 2-mm.

red, and 5-mm. red one after another. If I am not sure that there is diminished vision in an area (that is, a relative scotoma), I can use "rapid comparison." By this, I mean a rapid comparison of vision in the questionable area with that in an area in which the patient professes to have good vision. If this vision is not brought out well with 1-mm. white, it may be brought out with 5-mm. red or 3-mm. red, and it is an advantage to have all these test objects available for rapid use.

An improvement on the combination of the painted wooden handle and the Berens pin would be plastic test objects permanently affixed to plastic carriers, the whole unit being in one piece. The handles of the set I plan to have made are to be of black, unpolished plastic, tapered at the end to which the plastic spherical test object is to be permanently affixed. Such a complete plastic set will eliminate the need for painting and will do away with the occasional breaking off or falling out of the pins from the dowels. Such equipment can easily be cleaned with a damp cloth without the danger of dislocating the pin, as in the wooden holder, and the colors will be permanent.

I have devised several other types of test-object carriers based on the principle that the carrier should simulate the background. The frame is made with flat, thin steel such as is used for stays in women's girdles. The shaft of the Berens pin is soldered to the end of the steel, and the presenting surface of the steel is covered with a length of the same felt or flannel that was used in making the tangent screen. The steel should be no more than $\frac{1}{4}$ to $\frac{1}{2}$ inch in width, so that the carrier, when overlapped by the material, is no wider than $\frac{1}{2}$ to $\frac{3}{4}$ inch. A carrier of this width is preferable to a narrower one because the wider piece of flannel, with edges more distinctly separated, is less

distracting. It is also easier to keep a wider carrier more nearly parallel to the plane of the screen, thus avoiding shadow. In cutting the edges of the felt, it is well to bevel them so that the bevelled edges will face the screen and not the patient. This is worth while doing because the bevelled edges stand out from the smooth surface of the tangent screen.

The pin is soldered so that only about $\frac{1}{8}$ -inch of shaft near the head projects beyond the end of the steel blade and is not covered by the felt. Dull black thread, such as Clark's black darning thread, is used to sew this felt to the steel. No stitches should appear on the presenting surface. The small $\frac{1}{8}$ -inch neck of shaft, between the end of the steel and the pin-head is covered by winding this thread around it. A flat surface is better than a rounded one such as the wooden dowel has, because a flat surface is less likely to give off a highlight. This test object is shown in Figure 3C. These test objects are also kept in an upright position so that the presenting surface and test object do not touch anything when not in use.

Another test object carrier that I have made has its size increased sufficiently to permit the object to be completely surrounded by the exact felt as was used for the screen. The frame for this carrier is fashioned from a sturdy steel wire, about $\frac{1}{8}$ inch in diameter. This wire is shaped into an oval about 6-inches wide and 9-inches long, with a handle about 5-inches long. A piece of the tangent-screen felt is stretched tautly over it. All of the stitching appears on the nonpresenting surface. The handle is also covered with the same felt. This carrier resembles a large ping-pong paddle.

The 1-mm. white pin is now grasped with a hemostat at the shaft adjacent to the head, and the remaining length of the shaft is bent until it is at right angles to the smaller portion between the hemostat

blades. The pin now looks like the letter "L" with the test object at the end of the shorter limb. The point of the shaft is now plunged through the center of the felt carrier about four inches from its rounded end, and, at the bend, turned at right angles so that the test object presents without any shaft showing, the short neck of the shaft going through the felt at right angles to the plane of the felt. The long end of the shaft now lies on the nonpresenting surface of the felt, and the point is engaged in the superficial fibers of the felt without going through it, and the test object is ready for use. This paddle-shaped test object is shown in Figure 3A.

Before using this test object, tell the patient that he will see a large black surface approaching and that at a certain point, a little white head will appear through the center. By having the test object completely surrounded with black felt for at least 3 or 4 inches in all directions, perfect contrast without interference is achieved. The patient can also recognize the test object more accurately because he knows where the object will appear and keeps his attention there, even though central fixation is well maintained. This gives a more accurate measurement of the field.

The carrier is moved slowly toward the point of fixation and, when the patient makes out the tiny white test object, the carrier is held in position and, with his other hand, the operator holds a black-headed pin over the white test object. The carrier is then withdrawn, and the black-headed pin is pushed into the screen.

The author has found this paddle type of carrier quite satisfactory in mapping out the 1/2,000 field. However, it is unsuitable for use within 2 or 3 degrees of the fixation point, since the surrounding carrier overlaps the fixation point at these limits.

INTERPRETATION OF FINDINGS

The normal isopter for 1/2,000 white in good illumination is reported differently by various observers, as shown in Table 1. Figures for this table are taken from Traquair.³

One must remember that this visual angle is very small and undoubtedly differs with various lighting backgrounds, reflections from test objects, types of carrier, technique of examination, and so forth. Considering all of these factors, it is not at all surprising that there are discrepancies in the findings of these observers. I believe that each ophthalmologist should observe the 1/2,000 field for a small series of normal subjects on his own screen in order to see which of the reported isopters is closest to the average isopter he has found on his own screen.

the test object temporal to the blind spot—usually over a narrow zone of 3 or 4 degrees. Therefore, this area must be explored carefully. In cases of papilledema, in which the blind spot extends as far as the 21- or 22-degree meridian with a 5- or 10-mm. white test object, there may be some additional pericaecal scotoma for 1/2,000 white, thus bringing the caecal area out perhaps to the 25- or 30-degree meridian. This would cause breaking through to the periphery for 1/2,000 white, thereby interfering with the 1/2,000 test in the sense that one might get the impression of a temporal slant; whereas, the depression is really due to the enlarged blind spot.

SUMMARY

1. The importance of the 1/2,000

TABLE 1

NORMAL ISOPTER FOR THE 1/2000 FIELD AS REPORTED BY VARIOUS OBSERVERS

Observer	Angle In	Object in mm.	Distance in mm.	Field in Degrees			
				Out	Down	In	Up
Walker	1.72	1.2	2,500	20	18	17	17
Sinclair	1.72	1.0	2,000	26	25	26	24
Hefftner	1.72	1.0	2,000	22	18	18	15

He should then use that reported isopter for the normal.

However, the exact extent of the 1/2,000 field is not really very important. Certainly, because of the discrepancies in different reported normals, little to no importance should be attached to small concentric contractures in this isopter in the absence of other perimetric evidence of interference with the visual pathways. Much more important is localized depression such as a definite temporal or bitemporal slant, homonymous hemianopia, and so forth.

A word of caution regarding the 1/2,000 field in the neighborhood of the blind spot is in order. In most cases, with good lighting, the normal patient will see

white isopter is emphasized as one of the more sensitive and practical tests in quantitative perimetry.

2. Some of the difficulties encountered in the use of this small visual angle are discussed.

3. Suggestions are made for the economical construction and care of individual, permanently fixed holders for small test objects, together with a cabinet for storing them.

4. A new type of carrier, based on a different principle, has been devised.

5. Suggestions are made for the interpretation of the findings for 1/2,000 white.

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THE CLINICAL USE OF DI-ISOPROPYL FLUOROPHOSPHATE (D.F.P.) IN CHRONIC GLAUCOMA*

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Recently several articles on the treatment of glaucoma with di-isopropyl fluorophosphate (D.F.P.) have appeared in the literature. D.F.P. is a colorless oily liquid which hydrolyzes rapidly in aqueous solutions with the production of hydrofluoric and di-isopropyl phosphoric acids. Chemically, D.F.P. is unrelated to eserine. Koelle and Gilman have shown that D.F.P. is stable in peanut oil for at least one year when kept in a stoppered bottle at room temperature.¹ They also found no deterioration after autoclaving D.F.P. in peanut oil for one hour at 117°C. From pharmacologic studies on various laboratory animals, it has been learned that D.F.P. inactivates the enzyme cholinesterase. Because of its prolonged action and the rate at which enzyme cholinesterase activity reappears, it has been concluded that D.F.P. acts by irreversibly destroying cholinesterase.² When instilled in the eye, it therefore produces symptoms of marked parasympathetic activity which include miosis and contraction of the ciliary muscle.

ANIMAL EXPERIMENTS

Scholz found that, when sublethal or repeated doses of D.F.P. were instilled in the eyes of rabbits under ether anesthesia, tension rose simultaneously with the

pupillary constriction and did not begin to return toward normal until approximately 15 minutes later.³ Histologic examination of eyes removed with the tension elevated showed epithelial blisters on the ciliary processes, engorgement of the vessels, and coagulated protein in the anterior chamber. Scholz and Wallen, however, found that normal human eyes exposed to D.F.P. vapor showed a reduction in tension in all cases but one.⁴ The exception showed a slight rise in tension when measured at 10 minutes, but by three hours the tension had fallen below normal. Leopold and Comroe confirmed Scholz and Wallen's findings on normal eyes, but had no exceptions among their 12 cases.⁵ Leopold and Comroe demonstrated in human eyes that a 0.1-percent solution of D.F.P. was able to overcome the cycloplegic effect of 4-percent homatropine hydrobromide, and that a 0.2-percent solution of D.F.P. overcame 1-percent atropine sulfate.

CLINICAL EXPERIENCE

The clinical experience of Leopold and Comroe indicated that 0.05-, 0.1-, and 0.2-percent solutions of D.F.P. in oil were suitable for reducing the tension in cases of chronic simple glaucoma.⁶ They reported that solutions weaker than 0.05-percent failed to lower significantly the ocular tension in chronic glaucoma and that if a 0.2-percent solution was ineffective, in-

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creasing the concentration of D.F.P. was of little value. Because of the prolonged action of D.F.P., Leopold and Comroe cautioned that the frequency of administration of the drug could be determined only by carefully observing the effect on the individual patient. The vast majority of their controlled cases received the drug between the limits of once weekly and twice daily. Most of the cases analyzed by Leopold and Comroe fell into the group classified as chronic simple glaucoma. They reported results on eyes in which pilocarpine and physostigmine had been used unsuccessfully and in which D.F.P. subsequently was used. Of the 52 glaucomatous eyes treated, the use of D.F.P. was considered successful in 36 eyes.

In another report McDonald compared the efficacy of D.F.P. with other miotics in 122 eyes with chronic simple glaucoma uncontrolled by the use of either pilocarpine or eserine.⁷ He reported that 57 percent of the eyes in his series were successfully controlled by D.F.P.

CRITERIA FOR STUDY

This study is based on the use of D.F.P. in 32 eyes with chronic glaucoma in which the glaucoma previously was uncontrolled by the use of such miotics as pilocarpine (1-percent or 2-percent), eserine ($\frac{1}{4}$ -percent), and furmethide (10-percent). The criteria for listing the cases as successfully treated with D.F.P. are the following: (1) The patient should be willing to use the drug sufficiently long to permit a minimum observation period of four months. (2) As a result of treatment, (a) the ocular tension as measured by a Schiøtz tonometer should be maintained at or below 30 mm. Hg; (b) the visual field should show no further loss; (c) vision should be maintained at pretreatment levels provided there is no other obvious reason for a reduction in vision.

Cases were considered unsuccessfully controlled when: (1) The patient was unwilling to continue the medication because of its induced ocular pain or visual symptoms. (2) During treatment, (a) the tension was not controlled at 30 mm. or less; (b) the visual field showed further loss; (c) the visual acuity was reduced.

In this series D.F.P. was used in 0.05- and 0.1-percent concentrations in peanut oil and the frequency of instillation varied from once every two days to twice daily. This is essentially the same concentration and frequency of instillation employed both by Leopold and Comroe and by McDonald.

TYPES OF GLAUCOMA

The types of glaucoma occurring among the 32 eyes in this series and the number successfully controlled with D.F.P. are shown in Table 1.

In these 32 eyes with chronic glaucoma uncontrolled by the more commonly used miotics, D.F.P. was successful in lowering the tension to below 30 mm. Hg (Schiøtz) and maintaining such a reduction for four months in only five eyes—an incidence of 16 percent success. In 27 eyes, the drug was ineffective. In 3 of the 27 failures, the drug was discontinued early because of pain which was so severe that the patients refused further treatment. In the remaining 24 eyes, D.F.P. did not control the tension within satisfactory limits for four months.

McDonald reported that approximately 57 percent of his total cases uncontrolled by previous miotic therapy were successfully controlled by D.F.P. However, he did not give the number of cases of chronic glaucoma alone in his series. His figures, therefore, cannot be accurately compared with the results here reported. Leopold and Comroe's article presented all the pertinent data on the individual cases. Therefore, a further analy-

sis can be made and a comparison with the results here reported is possible. In their series there were 52 eyes with chronic glaucoma which failed to respond to previous miotics. According to their criteria, D.F.P. was successful in 36 eyes and unsuccessful in 16 eyes. When the results of treatment of these 52 eyes are analyzed, using the same criteria which were employed in evaluating the series here reported, there are only 39 eyes which meet the criteria of period of observation and results of treatment. These 39 eyes include 23 apparent successes and their 16 failures. However 8 of the 23 apparent successes do not meet our requirement that the patient be willing to continue the medication. Patients represented by 8 eyes were unwilling to continue the D.F.P. because of either severe pain, blurring of vision, or both. Thus only 15 eyes out of a total of 39, or 38 percent of the chronic cases reported in Leopold and Comroe's article could be classed as successes under the criteria laid down in this paper. In their series it would appear from the available data that the most which could be expected by the use of D.F.P. in chronic glaucoma uncontrolled by the more commonly employed miotics would be control in one of every three cases for a minimum period of four months. The small series here reported gives an even less optimistic view of the situation, only one in six cases being controlled for four months or longer.

COMPLICATIONS OF THERAPY

The complications of D.F.P. therapy which have been mentioned in the literature are: (1) The severe eye or brow ache which is especially common during the first few days of therapy. (2) The blurring of vision caused by ciliary spasm. (3) The occasional increase in tension which D.F.P. may produce.

The following complications occurred in the 32 eyes of our series. Four patients experienced so much pain that in three the therapy was discontinued, and in the fourth, morphine was required the first night to alleviate the pain. This patient was subsequently carried for several days without pain on D.F.P. One aphakic is included among the four which experienced severe pain. Two patients with aphakic eyes also experienced mild pain during the first three days of therapy which was not severe enough to make

TABLE I
TYPES OF GLAUCOMA OCCURRING IN 32
EYES OF THIS SERIES

Type of Glaucoma	No. of Eyes	No. Controlled by D.F.P.
Glaucoma Simplex	10 eyes	1
Glaucoma Secondary to Cataract Extraction	8 eyes	2
Glaucoma Secondary to Uveitis	4 eyes	0
Absolute Glaucoma	4 eyes	0
Chronic Congestive Glaucoma	4 eyes	0
Congenital Aniridia	2 eyes	2

the patient unwilling to use the medication.

Three patients with glaucoma simplex became so artificially myopic from ciliary spasm induced by D.F.P. that the resultant vision was unsatisfactory. For example, one of these patients had 20/20 corrected vision prior to the instillation of D.F.P. While receiving D.F.P. (1 drop of 0.05-percent solution, twice daily) in the left eye, her vision varied on different visits to the clinic from 20/50 to 20/100. A manifest refraction on a day in which the vision was 20/70 showed that a -2.5D. sph. lens was required to give 20/20 vision. Because of the variability of the ciliary spasm in this case,

the induced myopia could not be satisfactorily corrected by a permanent change in the spectacle lens. In three of the four eyes with chronic congestive glaucoma, the anterior chamber became more shallow after the use of D.F.P., without any reduction in tension. A reduction in depth of the anterior chamber was also noticed in several eyes with glaucoma simplex.

ADVANTAGES OF THERAPY

The advantages reported for D.F.P., when it satisfactorily controls the tension, are the convenient infrequency of administration and the absence of a local sensitivity reaction. The advantage of fewer daily instillations is somewhat offset by the pain which may occur and the temporary myopia which may result. One case treated with D.F.P. but not included in this series is of especial interest. In this patient, the use of D.F.P. apparently caused a ciliary spasm so severe that the resultant traction on the choroid and retina produced a retinal detachment.

REPORT OF A CASE

A 62-year-old white man, with moderate myopia corrected to 20/30 in both eyes, had glaucoma simplex, and the tension was satisfactorily controlled on pilocarpine (3 times daily) ordered by his local ophthalmologist. Because of the inconvenience of the mid-day dose, it was

decided to try D.F.P. Two drops of a 0.1-percent D.F.P. were placed in each eye and immediately following the instillation severe pain developed in both eyes and vision became blurred. These symptoms disappeared after 24 hours. The following morning (approximately 36 hours after the instillation of the D.F.P.) the patient noticed a grayish veil hanging down nasally in the visual field of the right eye. Metamorphopsia developed and the upper field became distorted. One month later when the pupil was dilated for the first time, the lower retina was found to be detached. The patient was then referred to the Wilmer Institute. On examination, a disinsertion of the retina in the lower temporal quadrant with detachment of the lower retina was found.

CONCLUSION

From our studies on chronic glaucoma, it would appear that when other miotics such as pilocarpine, eserine, and especially furmethide fail to control the tension, D.F.P. in the concentrations used has little chance of success. Furthermore, although D.F.P.* may be ineffectual, it is not always innocuous.

Johns Hopkins Hospital (5).

* The D.F.P. used in this study was supplied by Dr. A. M. Harvey, Dr. J. L. Lilienthal, Jr., and Dr. D. Grob of the Department of Medicine, Johns Hopkins Hospital, to whom the author expresses his thanks.

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NOTES, CASES, INSTRUMENTS

METASTATIC FUSOSPIROCHETAL ABSCESS OF THE ORBIT*

L. L. TITCHE, M.D.

Tucson, Arizona

Metastatic abscess of the orbit is not uncommon and orbital abscess caused by *Borrelia vincentii* and *Fusiformis dentium* is not rare, but the combination of the two is an unusual occurrence. In most instances the latter condition is the result of the extension to the orbit of an infection of the maxillary sinus following a dental infection. Dunnington and Khorazo,³ in 1936, reported a survey of the literature and found only 13 cases of ocular infection due to *Borrelia vincentii* and *Fusiformis dentium*. Walker⁴ reported a case of abscess of the orbit and suppurative panophthalmitis produced by these organisms as the result of an infection of the maxillary sinus following the extraction of a tooth. Burch² reported a case of metastatic orbital infection from a staphylococcic pulmonary infection. Berens¹ stated that metastatic abscess of the orbit occasionally arises in infectious diseases, scarlet fever, chicken pox, and influenza, and from surgical operations for infections in other parts of the body, as pelvic cellulitis and uterine disease. Because of the rarity of the condition, it is believed that the following case is worth reporting.

CASE REPORT

R. M. C., a white man, aged 52 years, was admitted to this hospital on October 10, 1944, for the treatment of bronchi-

ectasis, severe, bilateral. The pulmonary condition was too extensive for surgery and his therapy consisted of postural drainage and frequent bronchoscopies with the insufflation of sulfonamides into the bronchial tree. Sputum examination yielded Gram-negative fusiform bacilli and spirilla on smear.

On January 14, 1946, he complained of pain in the right eye. Examination revealed slight puffiness of the right lower eyelid, but intraocular examination was negative. Heat was applied, and two days later the swelling had increased and it was noted that ocular motion was limited.

On January 16, 1946, an abscess on the outer aspect of the left arm was incised. Purulent material was found which had a very acrid odor and was rather viscous and gray in appearance. Smears of this material revealed many spirilla and Gram-negative fusiform bacilli, but there was no growth on culture. By the following day, there was marked swelling of the right lower eyelid and fluctuation could be felt. The conjunctiva was markedly injected and the globe was proptosed about 6 mm. and fixed. A 22-gauge needle was introduced in the area of fluctuation and pus was encountered at a depth of 3 cm. Aspiration yielded 4 cc. of thick, creamy, purulent material with a foul acrid odor. An incision was made along the needle to the abscess cavity and a drain inserted. Smears of this material were found to contain bipolar staining bacilli, Gram-positive cocci in chains, and spirilla. No growth was obtained on culture. The abscess was irrigated frequently with 20,000 units of penicillin in 2 cc. of normal saline and within a week had completely healed. The proptosis subsided rapidly, but some

* From the Veterans Administration Hospital. Published with the permission of the chief medical director, Veterans Administration, who assumes no responsibility for the opinions expressed or the conclusions drawn by the author.

limitation of motion of the globe persisted for several months.

On January 28, 1946, an abscess on the anteromedial aspect of the left thigh was incised with the finding of purulent material similar to that above. During this time a series of daily blood cultures for five days was reported as sterile after two weeks' incubation.

SUMMARY

A case of metastatic abscess of the orbit, accompanied by metastatic abscesses in other parts of the body due to *Borrelia vincentii* and *Fusiformis dentium* infection of bronchiectasis, has been reported.

Veterans Administration Hospital.

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TECHNIQUE OF CATARACT OPERATION WITH THE ORAL-SUCTION CUPPING APPARATUS*

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Intracapsular extraction of the lens by means of suction in operations for cataract is an already known and approved method. It is the purpose of this paper to present an improved cupping apparatus and the technique of its use in order to acquaint ophthalmologists with a method of cataract extraction which is at once simple and safe.

Although it is not the aim of this paper to discuss the various techniques of cataract extraction, it would be well to refer to some of the fundamental principles upon which all these techniques are based. Among these are: (1) Complete anesthesia and akinesia of the eye. (2) Corneoscleral sutures complete with a conjunctival flap. (3) Peripheral iridec-

tomy. (4) Intracapsular extraction of the lens.

It is the purpose of this paper to demonstrate that, no matter what kind of cataract is being operated, the cupping apparatus under discussion is the ideal instrument to use to extract the lens itself. Simple to apply, its handling is easy and delicate. Since there is automatic control of vacuum, the surgeon is able to do his task with a feeling of security. Assuring a precise apprehension at a chosen point, it permits an almost nontraumatic rupture of the zonule. The nucleus turns within its own capsule so that its posterior surface becomes the anterior one when passing through the corneoscleral incision.

DESCRIPTION OF APPARATUS

The apparatus is made up of four parts: (1) The nozzle (the cupping part, itself) which is made of chrome-plated metal. This concha-shaped nozzle is one of the principal innovations of the instrument. (2) A chrome-plated metal tubular body. (3) A tube made of rubber. (4) A mouthpiece.

* Report presented to the V. Brazilian Congress of Ophthalmology, Salvador, Brazil, 1945.

As its name implies, the mouthpiece (fig. 1, no. 1) is held in the mouth, between both lips, in such a manner that suction is produced by the mouth muscles only. In this manner, the vacuum is regulated. The mouthpiece, 22 mm. in length, is made of an acrylic material and is easily sterilized in steam (autoclave or

portion of the apparatus is strong but light so that it can be handled with ease and can be made to follow every movement of rotation with dexterity. The rubber tubing is fitted to one end. At the other end is a polished conic joint. The nozzle, maintained in position by a delicate thread, is attached to this conic joint.

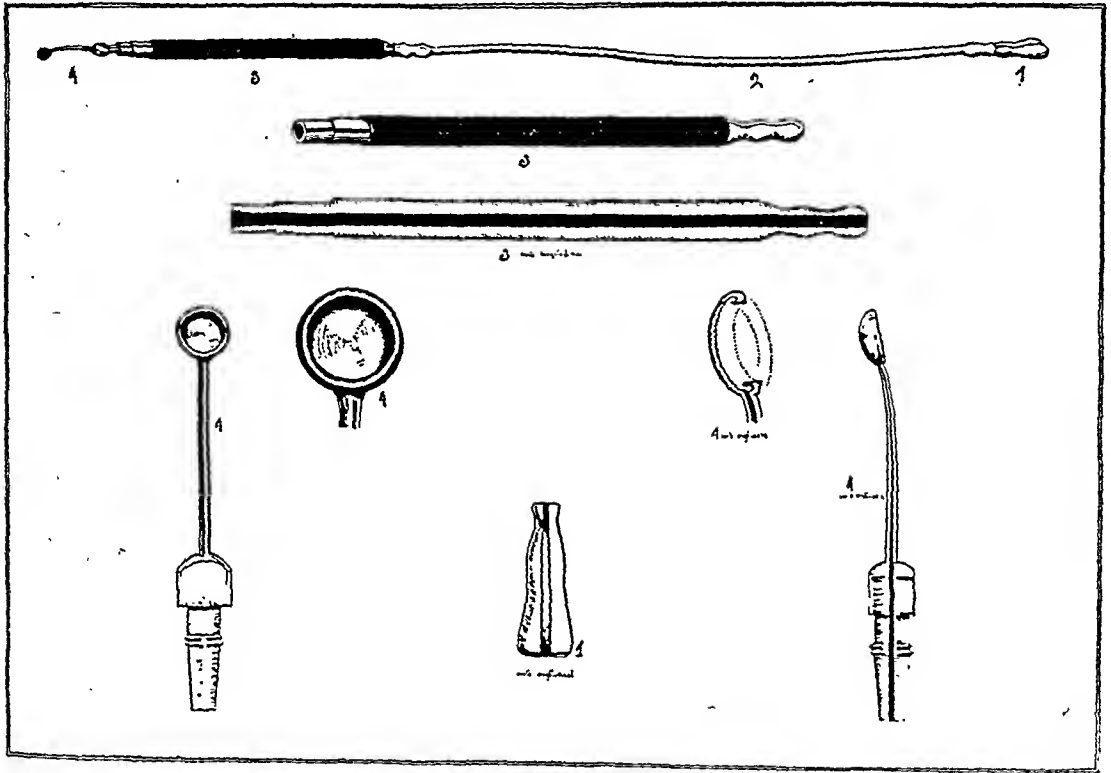


Fig. 1 (Falcão). Cupping apparatus for cataract operations (top) ready for use, and its separate parts: 1, mouth piece; 2, tube; 3, body; 4, nozzle.

sterilizer). It cannot, however, be sterilized by certain solvents, such as chloroform, various organic acids, and so forth.

The rubber tube (fig. 1, no. 2) is able to withstand a pressure of 90 cm. Hg. Its average length is 40 cm.; its diameter, 1.5 mm.; its circumference, 3.5 mm. It is designed to link the mouthpiece with the body of the apparatus.

The body (fig. 1, no. 3) is a hollow, chrome-plated metal cylinder, 12.5 cm. in length. Its circumference is 8 mm. Simple in construction and like a pencil, the body

The body can be sterilized by steam or hot air, as well as by certain chemicals such as formalin.

The nozzle (fig. 1, no. 4) is a small and thin chrome-plated metal tube. At one end is the trunk which fits the conical joint of the body. As has been mentioned, a thin thread fixes the nozzle on the joint and makes the connection airtight. A careful test must be made to see that an airtight connection has been achieved.

At the other end of the nozzle is the concha which, when introduced into the

anterior chamber in juxtaposition with the anterior lens capsule, grasps the cataract. The nozzle can be sterilized with either steam or hot air.

Nozzles of two sizes accompany this apparatus. The smaller one (diameter, 2.4 mm., circumference, 3.4 mm., depth,

of its small size (its diameter is less than the length of the jaws of Arruga's capsule forceps), the concha has a large gripping capacity. The circular edge of the concha has no abrupt angles (fig. 1, no. 4). Its somewhat concave shape gives it an area of sufficient size to permit it

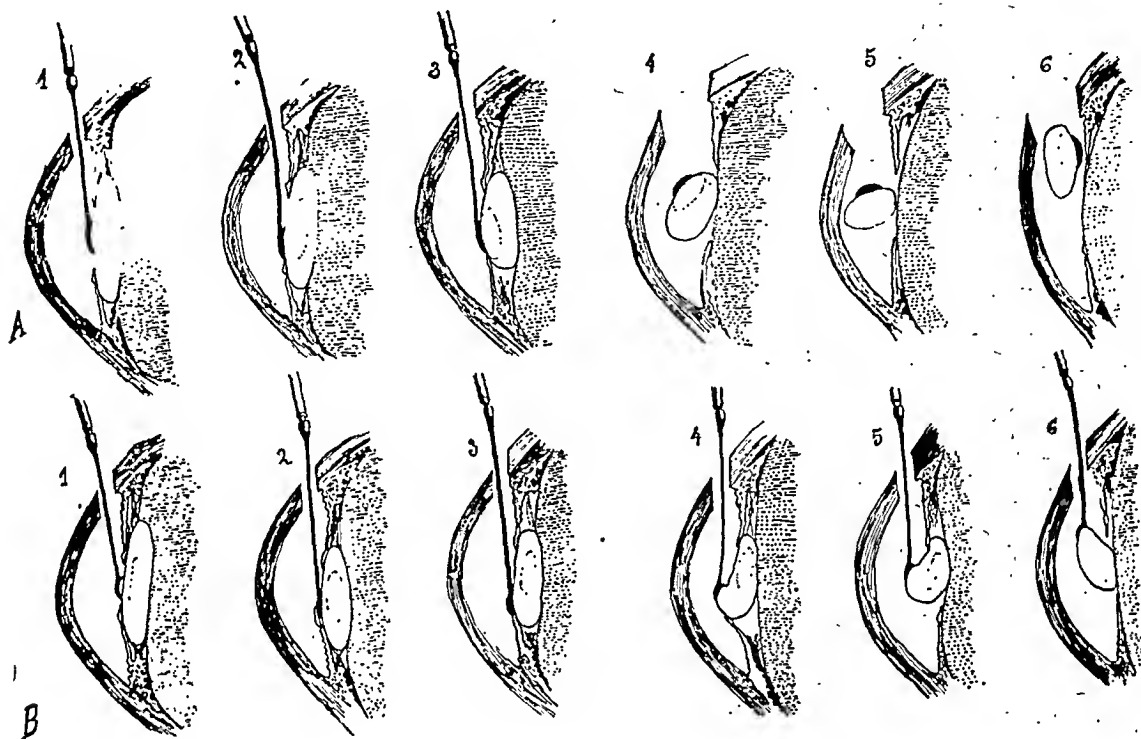


Fig. 2 (Falcão). Technique of grasping and extracting the lens with (A) the larger cupping apparatus and (B) the smaller cupping apparatus. (Author's note: In order to make the subject matter more clear, the above drawings do not keep the precise anatomic relation.)

1.7 mm.) is designed to extract the lens without turning it to 180 degrees. The larger nozzle has a diameter of 3.4 mm., a circumference of 4.6 mm., and a depth of 1.7 mm. It was designed for use in the operating of hypermature cataracts with large, hard nuclei. The technique of lens extraction with this nozzle is similar to that employed in the use of several well-known cupping apparatuses. A rotating movement of 180 degrees is used to extract the lens with the capsule and nucleus intact.

The innovation peculiar to these nozzles is the shape of the concha. In spite

to adhere no matter from what angle the manipulations are performed.

TECHNIQUE OF OPERATION

Although the management of the cupping apparatus is simple, its operation requires extreme care and delicacy. It is also essential that illumination be adequate and correct.

Use of smaller nozzle. Assemble the various parts of the apparatus and check to see that they are in perfect working order. With the eye under proper mydriasis, the cupping apparatus is introduced, preferably through the temporal side of

the wound. It is passed down over the iris close to the inferior edge of the lens, and the concha is gently applied to the anterior capsule.

When the proper moment for grasping the lens has arrived, vacuum is created by suction on the mouthpiece of the apparatus. The operator devotes his attention to rupturing the zonule and the hyaloid-capsular ligaments. He can increase or decrease the suction. The maneuver of detaching the lens is identical to that employed with forceps. All that is needed is to raise and gently withdraw the nozzle and lens. If necessary, a circular tenaculum or a stilet may be used below the place of zonular adherence to complete the rupture of the crystalline ligament.

Use of large nozzle. In general, the technique employed with the larger nozzle is the same. There must be sufficient mydriasis to permit the adjustment of the concha somewhat below the horizontal meridian of the lens. After the zonule has been ruptured, a movement of rotation is set up at the same time that the cupping apparatus is lifted and withdrawn. The nucleus and its capsule come out adhering to the concha.

It is important to remember that, during the use of the cupping apparatus, the power of adhesion is always increased when traction is exerted in a direction perpendicular to the plane at which the concha adheres to the surface.

DISCUSSION

Since the extraction of the lens has, throughout all the periods of cataract operation, been a most delicate and difficult problem, any technique which facilitates its removal and prevents accidents must be considered an improvement. My aim, therefore, has been to simplify to the utmost techniques already in existence. Mathieu, in 1866, and Hertz of

Vienna, at a later date, removed cataracts by suction, but their methods did not improve upon the then prevailing techniques.

As time went on, vacuum in the cupping apparatus was obtained by means of pneumatic pumps of various types. Evolution of the devices progressed from the pear of Stoeuer through the more modern electrical machines of Barraquer and Castroviejo to the fountain pumps of Dimitri, Rochon-Duvigieand, Arruga, and so forth. Fisher, of Chicago, decided to insert a diverticulum in the connection tube between the pumping engine (1/6 h.p.) and the cupping apparatus itself. His diverticulum is of rubber and has a mouthpiece by means of which the vacuum is regulated. This does not, however, afford an entirely satisfactory means of regulation.

After giving fair trial to these various types of cupping apparatus, I concluded that to be truly satisfactory the apparatus should have these features: (1) Perfect vacuum, perfectly regulated. (2) A nozzle sufficiently small to permit insertion through half-dilated pupils. With the cooperation of Dr. Cintra do Prado, professor of physics at the Polytechnic School in São Paulo, and his assistants, experiments for improving existing apparatus were undertaken.

By means of the mercury vacuum meter, temperature 24°C., corrected pressure 700 gm., we calculated that the oral vacuum produced by the mouth muscles oscillates between 350 to 450 mm. The highest vacuum obtained was 635 mm., exactly the amount produced by the pump of Barraquer. This eliminated the criticism that orally produced vacuum would be insufficient to permit the proper application of the cupping apparatus.

The grasping power of the cupping apparatus does not, however, depend entirely upon the production of a vacuum.

Earlier failures did not depend upon the lack of sufficient suction power, alone. The structure of the nozzle by means of which the lens is grasped was also at fault. I felt that the area which would adhere to the crystalline lens could be increased, and that better adhesion could be achieved.

To substantiate this theory an interesting experiment was devised. A small ball made of thin rubber was filled with water and placed on a coin balance. The liquid tension inside of the ball was similar to that of a swelling cataract, and the ball was stout enough to support a traction force greater than any crystalline lens could endure without breaking up.

The nozzle of the cupping apparatus was adjusted to this ball, vacuum was created, the ball was drawn slowly and progressively toward the scale of the balance, and its weight in grams was noted at the precise moment of its liberation. Following this plan, the efficiency of a number of different types of cupping apparatuses, in which the suction pressure registered from 200 to 700 mm. Hg, was measured. The results showed that the only cupping apparatus approaching ours in efficiency was that of Barraquer and of Rochon-Duvigieand. The results for our apparatus showed:

	<i>Small Nozzle</i> (2.4 mm.)	<i>Large Nozzle</i> (3.4 mm.)
<i>Vacuum</i>		
700 mm.	60 gm.	95 gm.
400 mm.	35 gm.	55 gm.

After testing the same cupping apparatus several times, employing strong oral aspiration, we recorded these results:

Oral suction using small nozzle measured 45 gm.; using large nozzle, 85 gm.

Since the normal lens weighs between 0.20 and 0.30 gm., we concluded that our cupping apparatus was capable of lifting 200 to 400 times the weight of a normal lens. This would be more than the power needed to rupture the zonule and to extract the lens.

After the results of these preliminary experiments were corroborated by work done on the eyes of animals, we operated on 12 patients from the clinic with this apparatus. Eleven of these operations were successful. The 12th case, that of a boy, aged 16 years, failed because of the unbreakable resistance of Zinn's ligament.

SUMMARY

A cupping apparatus constructed on the principle of oral suction is presented. The mouth muscles are used to produce sufficient vacuum, and respiration is not disturbed. Between 350 and 450 mm. Hg pressure is required to extract the lens, and this amount of pressure can be regulated automatically. The apparatus is equipped with a smaller and a larger nozzle. Either size can be used with equal ease; the smaller is designed for extracting the lens without turning it to 180 degrees; the larger is to be used when a rotating movement of 180 degrees is required. The simplicity and security offered by the technique of this method of intracapsular cataract extraction recommend its use.

Rua Visconde de Inhaúma—59.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

December 19, 1946

DR. BURTON CHANCE, *chairman*

PATHOGENICITY OF DIPHTHEROIDS ISOLATED FROM HUMAN CONJUNCTIVA*

DR. CHARLES WEISS,[†] and MR. M. C. SHEVKY,[‡] presented this subject. Diphtheroids, resembling *C. xerose* and isolated from the human conjunctiva grow well in a menstruum of mucin. Similarly, when suspended in this medium and inoculated into the anterior chamber of the eyes of albino rabbits, cultures retain their viability for several days, although they are rapidly destroyed in salt solution.

Intraocular injections of rabbits with diphtheroids, suspended in saline, produce moderate inflammation of the ciliary process. When suspended in mucin, the reaction lasts longer, is much more severe, and is associated with an acute keratitis. The lesions usually regress spontaneously within 2 or 3 weeks.

When killed cultures of diphtheroids in saline produce mild inflammatory changes in the ciliary process which can be seen in histologic sections; none are visible grossly. In a menstruum of mucin, the inflammatory reaction is more severe.

* From the Laboratory for Ophthalmic Research, Mt. Zion Hospital, San Francisco, California. Aided by a grant from the Columbia Foundation.

[†] Present address: Laboratories of the Jewish Hospital, Philadelphia 41, Pennsylvania.

[‡] Now at the University of California, Department of Bacteriology.

Since mucin by itself is relatively innocuous, it is suggested on the basis of these studies and those of others that it protects bacteria from the digestive action of humoral and cellular proteolytic enzymes and other immunologic defense mechanisms. Living diphtheroids are thus permitted to grow and exert their pathogenic activity.

By means of the recently developed methods of Muller and Miller and Pappenheimer and Johnson, it was possible to demonstrate that when diphtheroids are grown in a medium of very low iron concentration, they yield a toxic filtrate which is injurious to the uvea and cornea but not to the skin or conjunctiva of albino rabbits.

Studies which had been planned on the specific chemotherapy and serotherapy of diphtheroids were interrupted because of the war emergency.

On the basis of these investigations, it may be concluded that diphtheroids which are present on the normal or the inflamed conjunctiva may be considered as potential pathogens which can exert serious injury when they find their way into the interior of the eye.

Discussion. Dr. Luther Kauffman: I wonder, from a practical point of view, in treating conditions involving the conjunctiva whether the proper procedure would be to get rid of the mucin. I am reminded of the solution of monohydrated sodium carbonate, which Dr. Leherfeld presented before this section some years ago in his treatment of vernal conjunctivitis. It would also be interesting to ask Dr. Weiss if he knows whether other bacteria receive the same protective help from mucin as these diphtheroids do.

Dr. Burton Chance: The early death of diphtheroids reminds me of my own experience in the early days of my medical practice, when diphtheria was a frequent disease. For two winters I volunteered at the old Municipal Hospital. In one week, 275 sick persons were inspected. There were a good many patients there because the bacteriologist, who was at the summit of bacteriology at that time, had found what he believed to be the diphtheric organism in the conjunctiva and fauces. A few days after the children were admitted, another examination was made, with negative results, which created more than a headache, both on the outside and inside the hospital. The children were interested to know whether or not it had been true. The people outside were kicking because their children had been taken away from home and isolated. Having to have their own toothbrush and to carry out other hygienic measures were the sources of complaints from the children. Also, there were no signs of the old diphtheria of the conjunctival tissues that prevailed in earlier times. My teachers would refuse to accept a diagnosis of diphtheria unless there were actual structural and infiltration changes. Your statement concerning the evanescence of the diphtheroids, therefore, has reminded me of that somewhat confusing experience.

Dr. Charles Weiss, in closing, replied to the first question: Generally speaking, mucin on the inflamed conjunctiva is due to bacteria. Of course, it may also be due to chemical irritants. It seems reasonable, on the basis of our work, to remove it.

I mentioned in the course of my presentation that the virulence of a number of other bacteria is increased by mucin. Among them are: the meningococcus, the gonococcus, *V. cholerae*, and also the virus of influenza.

EXPERIENCE IN TESTING THOSE WITH DEFECTIVE COLOR SENSE

DR. BURTON CHANCE stated that from his earliest years, even in his first school days, he became aware that some persons were color blind, and ever since then he has been interested in color. In recent years, that visual defect has become the subject of so much investigation that he has ventured to tell something of his own interest in it and to express his beliefs concerning it.

The perception of color by human beings is an intellectual process involving psychologic and physiologic factors operating with the effects of light upon the chemical elements in the retina. The average person is able to distinguish all seven colors in the visible spectrum, and it is not improbable that animals and birds perceive beyond what mankind can define. There occasionally is found one whose appreciable "spectrum" is shortened at either end, if not both ends. For others, the ends are only more or less indistinct. In certain persons, however, the extent of the spectrum is not present; hence the appellation—color blind. A better and more kindly term is achromatopsia. Men more than women are affected. It is hereditarily transmitted from one generation to another through females who might not themselves be known to be affected. In pure cases, the eyes are not visibly changed structurally. Disease of the retinobulbar may be accompanied by defect in color perception. The color manifestations of the defect are, however, not usually comparable to those of the congenitally deficient. A singular anomaly is shown by those who have a unilateral deficiency; that is, complete perception is possible with one eye.

The measurement of color perception has aroused serious consideration in the

arts and in transportation, as well as in the definition of members of the military forces. Many notable persons in history have been found deficient and, since it was a pronounced defect in the case of John Dalton, the famous English physicist, it has been given deep study and various schemes for testing have been devised.

Such tests have been composed of wools, colored charts, and colored lights which are compared or matched with certain standard colors selected after prolonged investigation. In practice, red and green have been the colors most frequently found deficient; hence, these colors have been adopted as the basic standard for all tests.

Color perception is an unsolved mystery. Many theories have been proposed, but none solves all the problems, although the advocates of each theory defend their hypotheses violently. Thus far, the theory offered by Thomas Young and later similarly arrived at by Helmholtz has the least uncertainties. According to Young and Helmholtz, each color excites its own system of nervous conduction to the brain's perceptions.

Being a congenital defect, color blindness cannot be cured or even reduced—all schemes proposed are only false promises. Individuals can be trained to distinguish more fully one color from another; yet, when standard lights or plates are modified, as by foggy atmosphere or color dilutions, the natural defects become manifest.

All subjects do not have identical defects—some lack one or two; others more, even all seven colors. Observers have, therefore, classified them according to the number. Some persons showing only a lessening of the color strength are classed as anomalous of those color classes. Increasing attention to the "anom-

alous" is being carried on today. Those persons to whom all colored objects appear to be black are spoken of as the monochromatic. Despite all the interest shown in the past 50 years, no new fundamental facts relating to the problem have been solved; their solution rests with the photochemistry of the retina.

Discussion. Dr. George F. J. Kelly: It is my impression that you spoke of several cases of normal color perception in one eye and abnormal color perception in the fellow eye. Was there any evidence of pathologic changes in the fundi of the abnormal eyes?

Dr. P. Robb McDonald: I have been interested in Dr. Chance's paper because, for part of the time that I was in the Service, I was working with those who were engaged in developing tests for color vision.

As Dr. Chance has said this is a rather confusing subject. I notice that he also stuck to the term "color defective." This is a much more appropriate term than color blind. There are a lot of people who have defective color vision but who are by no means color blind.

In setting up tests for color vision, there were certain facts that had to be known. They were essentially:

1. A "job analysis" to determine what color discriminations were actually required of pilots, bombardiers, air crew, and so forth.

2. An evaluation of the tests of color vision that were available.

3. The development of new tests.

4. The reproducibility, reliability, and validation of the tests that were adopted.

The problem of landing a plane in the daytime was not too difficult because usually other clues than color were employed to determine whether one was about to land on tilled or flat surfaces. At night the problem was more difficult. The

runway markers might be colored lights of low intensity, the landing might be made with glide-path indicators, or the only communication between the tower and the pilot might be by a directional light such as the "biscuit gun." Those who worked about the airplane also had to make certain color discriminations. The wiring was usually coded by color, the various fuses had color codes, and so forth.

What everyone wanted was a quantitative test of color vision. One of the closest approaches to this was a lantern developed by Dr. Louise L. Sloan. The test was modified from one developed by the R.C.A.F., which in turn was a modification of the Williams lantern. The test was called a color-threshold test, and consisted of presenting eight different colored lights at eight different intensities of illumination. The minimum intensity was that at which most normal individuals called the color correctly. A score of 62 to 64 was considered normal.

We were fortunate in having a considerable number of color-defective individuals at Randolph Field, and Dr. Sloan was able to test them on the various tests of color vision. In all, about six tests were used—the Ishihara, the American Optical Company's pseudo-isochromatic plates, an abridged edition of the same, the Rabkin polychromatic plates, an anomalscope test, and the color-threshold test. Several other tests were employed at one time or another. Either before or after this battery of tests, the individuals were given "practical" tests; that is, the identification of colored flares actually fired from an airplane, the identification of colored signal lights, the identification of colored codes on wires, and so forth.

On the basis of these tests, the color-threshold tester was the closest approximation to a quantitative test. I think that

in the future we may have two types of color-vision tests. One that we can do in the office to determine whether an individual is normal or not, and one which the military can use to determine whether a soldier is color safe or not.

Dr. Burton Chance, in closing: In the several instances where I have seen perfection in one eye but defective perception in the other, there were no visible changes in the fundus. It is more than likely that if it be true that the perception of color is generated by the action of light on the retinal pigment, there was something constitutionally lacking in such eyes as gave rise to the defect. Therefore, in this consideration, I would not class a unilateral case presenting changes in the fundus as a true case of color blindness.

I wish to thank you, Dr. McDonald, for telling us something of what was done in the last Army. I regret that I was afforded no opportunity to witness such studies personally.

George F. J. Kelly,
Clerk.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

January 15, 1947

DR. HOWARD F. HILL, *presiding*

COMPLICATIONS ENCOUNTERED IN KERATOPLASTY

DR. R. TOWNLEY PATON of New York introduced his subject with a discussion of essential preliminary considerations. Only homotransplants or autotransplants have proved successful. Of the four types of corneal transplants—(1) total corneal transplantation; (2) total lamella transplantation; (3) partial lamella transplantation; and (4) partial penetrating corneal transplantation—the last method

gives the best results in specially selected cases. He classified cases for operation as: (1) For cosmetic improvement alone; (2) favorable for improvement of vision; (3) partially favorable for improvement of vision; (4) unfavorable for improvement of vision; (5) for treatment of descemetocoele.

The most favorable cases are those in which there is a nebulous type of opacity, quite central, and in an otherwise normal eye. There must be no active corneal disease present, or active infection of the conjunctiva, sclera, or uveal tract. There must be no increased intraocular pressure and no vascularization of the cornea. Blood staining of the cornea and conical cornea usually indicate favorable cases. The partially favorable cases are those in which there is some vascularization present and in which the opacity is dense with little clear cornea surrounding it, cases of adherent leukoma, shallow anterior chamber, and some cases of corneal dystrophy. Aphakic eyes, as a rule, do not do well, but some good results have been obtained. Cases in which the scarring is not too dense but in which there is a marked reduction in the corneal reflex should be given a guarded prognosis. Unfavorable cases include most forms of dystrophy, most forms of lipid and calcareous dystrophy, trachoma where there is a dense vascularization, lime burns and powder burns, hyperirritable eyes in which the cornea is densely and completely scarred as the result of acid and gas burns, pemphigus, and cases of severe symblepharon.

Dr. Paton stressed that, no surgeon, no matter how well qualified, should attempt this operation before experimenting on animals and dead human eyes and refreshing his memory on the anatomy and physiology of the cornea.

The selection, obtaining, and preserving of donor material was briefly discussed. Types of operation are: (1) Use

of stencils; (2) double-bladed knife or square window; (3) the trephine or round window. The technique of these procedures was summarized. He feels that the trephine method is the most advantageous because: (1) Better cosmetic result is obtained. (2) It is easier to complete the cutting of the window with scissors. (3) There is less danger of dulling the edge of the instrument in sterilization because of the adjustable collar. (4) An outline is made more easily with no danger of perforation because of the adjustable stop. (5) The donor window can be cut completely, thus eliminating the use of scissors.

Dr. Paton also prefers to use two sutures of different color because: (1) This gives increased ease of tightening; (2) more even distribution of pressure can be obtained, especially when there is a tendency toward overriding of one side of graft; (3) there is less danger of complication if one suture becomes frayed or is accidentally cut; (4) if further reinforcement is desired before the ends are cut, the suture can be anchored diagonally opposite in the episclera near the limbus or in the corneal tissue at the limbus.

Several points of consideration at time of operation were noted. Eyes with nystagmus may be operated upon, but the results are not good, as these eyes are invariably amblyopic. Cataract extraction and squint operations should be done after and not before the transplant has been performed. In aphakic eyes, the sword knife or the Filatov prophylactic spatula should be used to hold back vitreous during operative procedures. Operations on children before the age of 8 or 9 years or on glaucomatous eyes, should be avoided.

The postoperative complications may be grouped as follows: (1) Those produced by poor technique and unsatis-

factory instruments may result in: (a) edema of graft, (b) poor fit which may also cause the anterior chamber to collapse, (c) anterior synechias which often cause clouding of the graft. (2) Those that result from poor choice of patient. (3) Poor donor material and vascularization. (4) Unforeseen complications, such as infections and stitch abscess. (5) Cataract. (6) Glaucoma.

In summarizing the results, Dr. Paton said that in favorable cases visual improvement from 20/200 to 20/15 may be expected, but the latter acuity is rarer, occurring in about 2 percent of cases. Most cases require, postoperatively, a high minus correction with a high cylinder correction. Conical cornea cases give favorable results, but should not be operated upon unless contact glasses are not well tolerated, or if visual improvement cannot be obtained further than 20/200. A large graft should be used in these cases whenever possible.

Discussion. Dr. Brendan Leahey in discussing Dr. Paton's paper, said that much more keratoplasty has been done in New York than in Boston, and that, in the 8½ years since he obtained his first clear graft, his own series had risen only to 40 cases. Despite this, however, he felt sure he could at least hold his own with Dr. Paton when it comes to complications. He had hoped that Dr. Paton would say more about the removal of blood vessels, as that has been one of his worst problems in getting cases ready for operation. Some of the vessels can be closed by means of cautery or diathermy applied to the vessel trunks at the limbus for 2 mm. He has done a very large number of these and, in general, his results were unsatisfactory. About 80 percent of the vessels soon reopen. Stripping is helpful when the vessels are large and superficial. He has done relatively few of these, but again, results of stripping alone are disappointing. Radiation is the most effective method when

combined with stripping or peritomy.

The radiation can be either X ray or radium. The effect is identical, if filters are used to get the same rays through. Radiation, however, works only on tiny vessels and new capillaries, so the larger trunks require the other methods.

The more popular method at present is to use Beta radiation by means of radon or radium in a special small pencil-like applicator as designed by Dr. Burnam at Johns Hopkins. With very slight care this can be applied by the ophthalmologist himself to the blood vessels for the requisite number of gram seconds.

Dr. Paton spoke of accidentally cutting sutures. It is disconcerting but not serious when one is occasionally cut. The cut suture may be pulled through and rearranged so that an extra knot can be tied. If this is impossible, a new suture can be inserted in the same holes or new ones, even though the eyeball is open, by using a little needle counter-pressure instrument. This instrument has two little pronged feet that stick against the cornea. The needle can be pushed between these feet without much trauma to the cornea. This instrument is also handy for repairing traumatic corneal or scleral wounds.

Among the postoperative complications, anterior synechia has been the most common in his experience. A slight anterior synechia at the edge of a clear graft is almost certain to cause clouding of the graft in a few months. It may cause proliferation of connective tissue on the back of the graft, or it may cause a haziness to the stroma and edema of the epithelium like dystrophy. There is also, of course, the danger of glaucoma.

If these synechias are freed through a small limbal incision without iridectomy, there are usually new anterior synechias created near the limbus. Dr. Leahey has freed anterior synechias on three of these cases (and also on some cataracts with

beginning edema of the cornea at the site of adherent iris pillars) by a simple and effective procedure. A scleral incision is made as for a cyclodialysis, but located only about 3 mm. outside of the limbus. The iris reposer is slid into the anterior chamber and the synechias swept away.

Proliferation of connective tissue on the back of the graft is not uncommon. It is practically sure to occur in the presence of anterior synechias. In other cases it grows in from fibroblastic tissue at the margin of a perfect graft. We have no treatment for this, as radiation here is not considered effective. Fortunately many cases may proliferate in only 1 mm. or so and then stop just about the time we are really getting worried.

Edema of the graft is another untreatable complication—provided it is not the result of anterior synechias or glaucoma. It may remain after operation; or some cases may be clear for 6 to 10 months, then suddenly develop slight edema of the graft and remain that way. Hypertonic saline or glycerine and vitamins seem to make no difference. One of the reasons for this edema is excessively dense scar tissue around the graft so that it has defective nutrition.

A minor complication which Dr. Leahey often finds is a large astigmatic error. He has a number of cases in which vision is near normal with cylinders of between 2 and 7 diopters. In one recent case having both a transplant and a cataract extraction, vision was improved to 20/30 and J1 with a: +4.00D. sph. \ominus 12D. cyl. Vision in these cases could be improved to 20/20 with contact lenses. Although he is doing a lot of contact-lens work, he has not yet prescribed one for a transplant case. Incidentally, in cases such as this, in which, both the cataract and the transplant are necessary, the transplant should always be done first and the cataract extraction second.

In closing, Dr. Leahey said that although the unpleasant features of this operation have been presented, he is very enthusiastic about the results of this procedure and that, in case of need, he would not hesitate to recommend the operation to a member of his own family or to submit to it himself. He added that in this event he would be glad if Dr. Paton were the surgeon working on him.

DR. EDWIN DUNPHY then spoke of the organization of the Eye-Bank in Boston as a branch of the Eye-Bank in New York. On Dr. Dunphy's request, Dr. Paton discussed the organization and operation of the New York Eye-Bank, stressing the need of the material not only for keratoplasty, but also for research.

Mahlon T. Easton,
Reporter.

SOCIEDAD OFTALMOLOGICA DE MADRID

January 17, 1947

SUPRASellar CHORISTOMA

DR. OBRADOR, DR. BARTOLOZZI and DR. CARRERAS MATAS presented a patient in whom the ophthalmic examination disclosed bilateral papillary atrophy, with total loss of vision in the left eye and a scotoma in the upper temporal quadrant of the right eye. The diagnosis was a probable suprasellar tumor. Dr. Obrador operated and removed a tumor which was situated between the optic nerves in front of the chiasm. The anatomic-pathologic examination showed that it was a choristoma. A few days after the operation the visual field of the right eye was considerably improved, and the acuity of this eye rose from 3/50 to 9/10.

Discussion. Dr. Marin Amat: This morning I saw the patient in my ophthalmologic service in the Provincial Hospital and could see total atrophy of the papilla of the left eye and partial atrophy of the

papilla of the right eye; but since in the latter eye the atrophy had all the characteristics of a postneuritic atrophy (thickened contour of the papilla, thin arteries), I wonder if in the beginning, before being operated, it might have been treated as a case of Foster-Kennedy Syndrome. The result is clear, the finding and the extirpation of the tumor.

Professor Carreras. The case which has just been discussed by Dr. Bartolozzi and Dr. Carreras Matas, as ophthalmologists, and by Dr. Obrador, as a neurosurgeon, shows how necessary it is to have the collaboration of the ophthalmologist, the internist, and the neurosurgeon in order to treat with the greatest degree of skill a clinical case which is more or less complicated and which none of the specialists working alone could have solved satisfactorily. The fact that this patient shows complete amaurosis of one eye with complete optic atrophy; and, in the other eye, incomplete optic atrophy, with a visual-field defect of a complete upper temporal and part of a lower temporal sector, the vertex of the sector reaching onto the fixation point, makes me diagnose the case as one of an intracranial lesion (probably a tumor) which started in the chiasmal region and which extended mainly toward the left side interfering with most of the crossed fibers from the right side and all the fibers (crossed and uncrossed) of the left optic nerve. My diagnosis is supported by the fact that the X-ray studies show the sella turcica to be apparently normal.

CONJUNCTIVAL COVER FOR INJURY

DR. MARIO ESTABAN showed a case of a penetrating injury to the eye. There was a scleral tear of about 7 mm. at the edge of which vitreous began to appear. His first thought was to enucleate the eye; however, he limited himself to the use of a conjunctival cover. The eye recovered and has vision of 2/3.

In ocular traumas we shall be better surgeons if we do fewer enucleations. It is necessary to adopt a conservative attitude when there is something which can be saved.

Repair of a scleral wound can be made either by closing the edges or by using a covering of conjunctiva. A good method of treating the edges directly is to use a double-armed suture which brings the edges of the sclera and conjunctiva together at the same time. There is, however, the disadvantage that one has to exert pressure on the globe in order to force the needle through the fibrous tissue of the sclera.

A conjunctival covering, on the other hand, can be made easily and without pressure. One good method is to detach the conjunctiva at one of its edges and bring a small strip over to the opposite side so that when the suture is made the conjunctiva slides over the scleral wound and keeps it covered.

Discussion. Dr. Carreras said that he agreed with Dr. Mario Estaban that one should not be hasty to enucleate an eye which is seriously injured, although the chances of saving it may be small. Some 21 years ago he published a paper, describing the case of a patient who, during a wild carnival frolic, had a lemon thrown in his face with such force that it broke the lens in front of his left eye and caused the temples of the frame to cut the eye, causing a wound which took in the whole vertical meridian of the cornea and included some 5 mm. of the sclera. There was a hernia of the iris and of the ciliary body, and vitreous appeared at the edges of the wound. The patient was rushed to a first-aid station, where the doctor did nothing but put a sterile pad on the eyes and advise that he be taken to an ophthalmologist for removal of the eye. Operating on him the same night, I reduced the hernia of the iris, sutured the cornea and the sclerotic, and then made a conjuncti-

val covering. After a binocular bandage had been applied, the patient was put to bed and protein therapy was started. The result was that the eye was cured. Final vision was $2/3$, and a myopia of 3 diopters, which the patient had had before the accident disappeared. The lineal cicatrix of the cornea is hardly visible.

Dr. Mario Estaban answered Dr. Carreras, thanking him for his discussion which supported his conservative procedure.

OPHTHALMOLOGIST AND CRANIAL SURGERY

DR. MARIO ESTABAN read a paper on "The Collaboration of the Ophthalmologist in Cranial Surgery in War."

War wounds produce a large number of serious cranial lesions in which it is rare not to find the ocular system more or less affected. The collaboration of the ophthalmologist and the surgeon is always effective and often indispensable for diagnosis, in treatment, and during the progress and postoperative course of cranial injuries. In diagnosis, the ophthalmologist can outline the difficult types of vascular lesions, oculomotor lesions, and lesions of the optic pathways and give their topography. This will enable the surgeon to fix accurately the indications and localization of the operative procedure.

In treatment, the surgeon and the ophthalmologist can work together in a great many cases in which there are many wounds and mixed lesions of the cranium and the eyes.

During the progress and the postoperative course of cranial injuries, a systematic ophthalmoscopic examination will give the surgeon information of a favorable condition or will put him on guard against complications. Hemorrhagic symptoms may disappear or appear later. An oculomotor paralysis may disappear (a transitory compression of the

nerve fibers by blood or exudate which have been absorbed) or it may persist (a bony compression, which remains, or section of the fibers, which have not regenerated); new forms of paralysis may appear, the cause of which, mechanical or infectious, will have to be sought.

Repeated examination of the visual field gives valuable data on the location of the lesions, the importance and the progress of the lesions, as well as the sequelae of the surgical intervention. I am reminded of a case of a Moor who was very much surprised not to be able to read Arabic, a language which he knew very well, and to be able to read Spanish which he knew but slightly. What happened was that his wound destroyed totally the right occipital lobe, with a consequent left homonymous hemianopia. It also caused a partial destruction of his left occipital lobe, with the consequence of a partial right hemianopia. Reading Arabic from right to left was impossible because the visual field was lost on that side; whereas, reading Spanish from left to right (in the direction in which he still had a useful visual sector of the field) was possible.

With reference to the phenomena of cranial compression, repeated ophthalmoscopic examination and measurement of the retinal arterial tension gives pertinent information. Diminishing tension indicates that a subdural hemorrhage is reabsorbed; unchanged tension shows a collapse of the lamina interna; increased tension, a serous arachnoiditis. It is no less interesting to determine the presence of cranial hypotension, following a large loss of intracranial fluid. Many poorly explained cerebral disorders (headache, migraine, and so forth) may be due to this cause and may be diagnosed by the fall in pressure of the retinal arteries.

Joseph J. Pascal,
Translator.

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THE 1947 ACADEMY MEETING

The 52nd annual session of the American Academy of Ophthalmology and Otolaryngology was held at the Palmer House in Chicago, October 12 to 17, 1947. A few more than 3,400 members and guests, some of whom were from the distant corners of the world, registered for the meeting. The weather was kind, although perhaps a little too warm, and the aura of the meeting was cheerful. For a short time at least, the members could forget the distress of the world and the

various political and economic conflicts that have been rubbing us into a state of irritability. The excellence of the program, the splendid and numerous instruction courses, the enjoyable social evenings, and a scientific exhibit that was better than average contributed to the evident success of the meeting. Under the able and wise guidance of the president, Alan C. Woods, of Baltimore, and the other officers of the Academy, the scientific sessions were conducted with expedition and dignity, worthy of the important

subjects that were discussed. Dr. Fredrick H. Verhoeff of Boston was the guest of honor. His prestige as investigator, surgeon, clinician, and teacher, and geniality and wit assured the members that the choice was a happy one. The affection and respect that the members hold for Dr. Verhoeff was attested to on many occasions during the meeting by prolonged applause and the award of a plaque by the Academy as a testimony to his outstanding service to ophthalmology.

In his president's address, Dr. Woods spoke on the present policies of the specialty board and the national societies in relation to the progress of ophthalmology. He pointed out the great influence of the various boards in the elevation of the standards of training and practice of the specialties during the past 30 years. He deprecated, however, the tyrannical requirement of a certificate by various hospitals, universities, and government services, in order to permit hospital practice, teaching advancement, or extra financial allowances. He suggested that it is now time to reconsider these requirements and to liberalize them. Dr. Verhoeff discussed, in inimitable fashion, the subject of "Some Problems Concerning Convergence." His address showed evidence of deep and prolonged thought on the subject and will deserve careful reading. The symposium on "Psychosomatic Manifestations" turned out to be an agreeable surprise, and those who were repelled by the formidable title, but stayed to listen anyway, were rewarded by the stimulating talks of Dr. T. A. C. Rennie on the "General Aspects," Dr. C. Stewart Nash on "Otolaryngology," and Dr. D. O. Harrington on "Ophthalmology." The members who were not present missed something noteworthy.

The symposium on "Corneal Transplantation" was arranged, logically discussed, and summarized so ably by the

collaborators, that it comprises an important and most significant scientific contribution to this widely publicized and spectacular subject. The finding that only 36 percent of 416 cases had a clear transplant will be most sobering to us after all that we have read in the newsprint about keratoplasty. The symposium showed that coöperative clinical studies such as this are of great value and the method should be applied to other subjects as well.

Dr. Otto Barkan's paper on "Technique of Goniotomy for Congenital Glaucoma" was outstanding. His contribution, the value of which is now rapidly being recognized everywhere, has stood the test of time and experience. Goniotomy is here to stay, beyond question, and is the only operation for this distressing and blinding condition that offers much hope for the affected infants. Other papers of ophthalmic interest are likewise worthy of remark, for the quality of the program was unusually good. The moving pictures, however, were disappointing, on the whole, in subject matter and presentation, although the photographic technique was excellent in most cases.

One hundred and nine individual and 30 continuous instruction courses in ophthalmology were given by 163 instructors. A total of 368 hours of instruction was provided, and each course was filled practically to overflowing. The demand for and the attendance of the courses show how valuable the members think they are. Thus, they maintain first place in the affection of the members and guests, who are hungry for such instruction and beg for more each year.

Dr. Francis Heed Adler gave the fourth Jackson Memorial Lecture on the subject of "Paralysis of Vertical Muscles," and Dr. Robert Thompson Tidrick delivered the second Wherry Memorial Lecture on "Advances in Surgical Hemostasis: Evaluation of Absorbable Agents."

Both of the lectures were most ably executed, and the audience was highly rewarded. This feature of the Academy meeting is assuming a conspicuous position in the affairs of the institution.

Two hundred and 64 candidates were admitted to membership this year, of whom 120 were ophthalmologists. Dr. Conrad Berens was chosen as president elect to serve in 1949, Dr. Ralph Ry-chener was elected first vice president, and Dr. Ray K. Daily was elected third vice president from the ophthalmologists. Cols. Dart and J. E. Ash of the U. S. Army Medical Department, Dr. Charles Sheard of the Mayo Clinic, and Mrs. Helenor Campbell Wilder of the Army Medical Museum, were elected honorary members. The Leslie Dana Medal of the St. Louis Society for the Prevention of Blindness was awarded to Dr. Verhoeff for his great services in the prevention of blindness.

The exhibits of Dr. K. W. Ascher (Aqueous Veins), Dr. Posner and Dr. Schlossman (Glaucoma), and Dr. A. D. Ruedemann (Radium in Ophthalmology) won first prizes in their respective classes. The exhibit by Dr. R. G. Ingalls on "Intraorbital Tumors" received honorable mention. Dr. Benjamin Rones' exhibit on "Ophthalmology in Cartoon" provided a delightfully light and humorous touch. It was cleverly arranged at the entrance to the exhibits and put one in a good humor both on entering and leaving.

The commercial exhibits were numerous and well displayed. Newer pieces of equipment, apparatus, instruments, and devices were to be seen and handled without trouble and in comfort. Their respective merits were the subject of vehement discussions by groups here and there.

The continuous success of these meeting testifies to the efficiency and hard work of the executive secretary, Dr. William L. Benedict, and the staff of secretaries

and officers of the Academy. There is no question of the sincere gratitude and appreciation of every member for their great services.

DERRICK VAIL.

THE FINAL OPHTHALMOLOGICAL STUDY COUNCIL COURSE

This summer the third and last Basic Course in Ophthalmology of the Ophthalmological Study Council has been in full cry, housed at Westbrook Junior College, in Portland, Maine. "Cry" is perhaps an inappropriate word, as the students who brought their families, with 30 children in all, had only four of the crying age or young enough to be properly termed "wetting agents." Families with infants occupied a small dormitory by themselves which had a kitchen, icebox, and laundry. Milk and diaper service were in attendance when they arrived. Single men, married couples, and families with children were housed in separate buildings.

The enrollment was the largest of the series, numbering well over 100. In addition, a small number of students came for part of the curriculum. Over half of the United States was represented. The first registrant was the long-distance champion. He had been serving as a medical missionary to Nigeria, in Africa. He drove from California, with wife and children, in a trailer complete with grandmother. In view of the already strained accommodations at the College, the requirement that students reside on the campus was cheerfully waived and this consignment went off to a trailer camp. Another outsider came from Honolulu. There were also seven Canadians. Seventy were veterans of World War II.

From a physical standpoint, it looks as though the course had finally hit upon the

ideal arrangement. Because the college was designed as an educational institution, the facilities were well adapted to the purpose, instead of the rather makeshift accommodations of the previous courses. The housing and food were more generous than the other ventures, yet the college gave the lowest rates so far. Besides the bedrooms, families had a sitting room, and the recreation rooms of the dormitories were also available. The College authorities and the chamber of commerce interested themselves in the entertainment of the visitors. This was not difficult, as Portland is a considerable tourist center, with lakes, mountains, and beaches nearby.

The course opened on the first day without rain for some weeks. Credit for this achievement was claimed by the city manager in a speech of welcome at an outdoor picnic on the opening day, given by the College to all members of the course. Steak was served—more steak, in fact, than was known to exist in this area. Other picnics were arranged, including a New England clambake for one weekend. This is a form of dissipation indigenous to this region, characterized mainly by unlimited quantities of lobsters, clams, potatoes, and corn, cooked in a cairn of hot stones and seaweed on the beach. Dismembering the shellfish is a trick second only to eating with chopsticks, and should be excellent preparation for the more difficult ophthalmic operations.

The faculty was a trifle larger, and, as in the previous courses, the instructors were distinguished teachers from many parts of the country. A few more subjects were added, such as lectures on therapeutics intended to prepare the students better for clinical work as residents and preceptees.

The instructors were surprised by the enthusiasm and industry of the classes.

This is, however, only the general experience of all educational institutions engaged in the training of veterans. The pleasant associations of this group, thrown together for an entire summer in this way, should naturally be renewed at future medical meetings, giving the members a ready-made group of friends. It ought to ease some of the curse of the meetings for the women at least. The council are convinced that one factor in keeping up the momentum was the weekly shot in the arm furnished by the interim examinations in the subjects covered.

The Study Council is being pressed to rescind the termination of these courses and hold another here next summer. No decision can be reached until the annual meeting of the Foundation of Vision of which this course is a subsidiary.

S. Judd Beach.

OBITUARY

THOMAS HALL SHASTID,
(1866-1947)

Dr. Thomas H. Shastid, ophthalmologist and author, died February 15, 1947, at his home at Duluth, Minnesota, at the age of 80 years. He was born at Pittsfield, Illinois, in 1866. He became his father's medical apprentice at the age of 10 years. From 1883 to 1886, he was a student at Eureka Collge. Eureka, Illinois. He studied medicine at Columbia University and the University of Vermont, receiving his Doctor of Medicine degree with honors at the latter institution in 1888. His B.A. degree was granted him later at Harvard where he graduated cum laude in 1893. He did postgraduate work at the New York Postgraduate Medical School, at the University of Vienna, and the University of Michigan. The degrees of Master of Arts and Bachelor of Laws were granted at Michigan. He received

the honorary degree of Doctor of Science at the University of Wisconsin in 1922.

Dr. Shastid practiced medicine at Pittsfield, Illinois, from 1889 to 1891; at Galesburg, Illinois, from 1894 to 1897; at Fairfield, Illinois, in 1903; Charleston, 1904; Marion, Illinois, 1905 to 1913. He held the chair of professor of History of Medicine at the American College at St. Louis from 1907 to 1912. In 1914, he specialized in ophthalmology and was certified by the American Board in 1917. He moved to Duluth, in 1922, where he resided until his death.

He was a member of the American Medical Association, American Academy of Medicine, American Medical-Legal and Toxicological Society, American Academy of Ophthalmology and Otolaryngology, American College of Surgeons, American College of Physicians, American Association of the History of Medicine, International Congress of Ophthalmology, Author's League of America, and numerous other societies. Dr. Shastid was an author of note as well as an ophthalmologist, and his score and more of published works cover such subjects as medicine, international peace, and war profiteering. He wrote two autobiographies, as well as several novels. The best known of his novels was *Simon of Cyrene*. He translated numerous medical volumes and journals from German, French, Latin, and Greek, and was a frequent contributor to scientific journals of all kinds. He also contributed heavily to the American Encyclopedia of Ophthalmology.

Dr. Shastid was an enthusiastic bibliophile. His library at the time of his death contained some 15,000 volumes and covered a wide variety of subjects. Every volume was carefully and systematically indexed. Book lovers gathered from far and wide when it was learned that his library was to be sold. There were

books on slavery, witchcraft, medicine, law, literature, philosophy, theology, history, music, and numerous other subjects. There were a number of rare old volumes including *Fitz-Herbert's Justice*, published in 1541. The library also included a collection of letters and signatures of famous people. Among them were a number of original copies of Abraham Lincoln's law briefs written in his own handwriting, a personal letter from Jefferson Davis, and communications from Henry Ward Beecher and John Jacob Astor. Dr. Shastid's wife died in 1940. After her death, he devoted much of his time to his books. Surviving him are an adopted daughter, Mrs. Donald R. Husband of Eugene, Oregon; two brothers, John S. Shastid, Kansas City, Kansas, and Joseph Shastid, Pittsfield, Illinois; and a nephew, John B. Shastid, New Castle, Pennsylvania.

A. C. Hilding.

BOOK REVIEWS

SENSORY MECHANISMS OF THE RETINA. With an appendix on electroretinography. By Ragnar Granit, M.D. New York, Oxford University Press, 1947. 412 pages, 178 illustrations, bibliography, and index. Price, \$11.00.

For the past 20 years Professor Granit and his many co-workers in the Royal Caroline Institute at Stockholm have zealously investigated the electrophysiology of the retina. The remarkable achievements in this field are now systematically and lucidly expounded. Probably the ophthalmologists of tomorrow will be as familiar with the pattern and interpretation of the electroretinogram as the internists of today are with the electrocardiogram. A pioneer text on clinical electroretinography has already appeared (Karpé, 1945), and Granit confidently predicts that the time will come when the record-

ing of the electroretinogram will be one of the standard methods of every well-equipped ophthalmic clinic, particularly in cases where, owing to opacities of the media, there is difficulty in making an ophthalmoscopic examination or using subjective tests.

The only means of securing information about the fast processes occurring in the retina itself lie in the electrical changes. Discrimination of intensity and contour are functions of the frequency and pattern of the optic-nerve discharges, respectively. The phases of excitation and inhibition emphasize the intensity gradient and give the higher centers the clue for sharpening impressions. The electroretinogram provides an objective basis for the analysis of visual sensation, and in the inter-relations of intensity, area, and duration of the stimulus have amplified the conclusions obtained through subjective methods. Various studies, including that of the pure rod retina of the guinea pig, indicate that besides the rods which accurately reflect the course of visual purple regeneration there are others, "cone" rods, which remain active after light adaptation, the difference being, apparently, wholly at the photochemical level.

A product of Granit's research is his challenging "dominator-modulator theory" of color vision. The scotopic curve is the only one obtainable from the dark-adapted eye, but in the light-adapted state certain elements show with his microelectrode technique restricted sensitivity curves, which Granit terms modulators. So far seven types of modulators have been found—two in the red, three in the green, and two in the blue. Units related to the rods appear responsible for the reception of short-wave lengths. Hue discrimination is best at 5,800 to 6,000 A.U., and 4,800 to 5,100 A.U., where the modulator curves overlap. The dominator curve rep-

resents the interaction of closely linked modulators acting as a functional unit. Such convergence could be the result of lateral connections through the amacrine cells, or synchronized impulses. The dominator and modulator mechanisms produce the fundamental sensations of brightness and color, respectively, which are to some extent independent of each other, as shown in deuteranopic color-blindness.

The numerous graphs which at first glance give the book an abstruse and formidable appearance are actually simple, carefully selected, and serve well in bringing the laboratory to the reader.

James E. Lebensohn.

EYE SURGERY. By H. B. Stallard, M.B.E., M.D., F.R.C.S. Baltimore, Maryland, The Williams & Wilkins Co. 444 pages, 338 illustrations. Price, \$11.00.

This new book on surgery of the eye is well worth the careful scrutiny of the ophthalmic surgeon. Most of the standard procedures are clearly and concisely given. As one would expect, the drugs and routines are more English than American. The emphasis on war surgery is greater than might have been expected in a text for peace time, but this is natural in a postwar surgical presentation. Many illustrative cases are given and these, especially the plastic, are mostly of battle casualties.

The reviewer is not convinced that illustrative cases, unless used very concretely to point out some definite thought, are of great value. No two plastic repairs are exactly the same and perhaps a textbook does well to restrict the number of such cases. This book, however, does not go to great lengths in this matter and most of the material is well chosen.

Some interesting new material is in-

cluded, such as the very simple operation for pterygium used by Sabri Kamel in Egypt in a great number of cases with complete success even in recurrences; and the operation by the late Sir Richard Cruise for chronic simple glaucoma. Among drugs not often used in the United States that are recommended are "novri-tox," a solution of novocaine, quinatoxine, benzoic acid, Ringer's solution, and adrenalin. For wide dilatation 'mydri-caine,' a compound of atropine, cocaine, and adrenalin, is suggested.

For intraocular operations the patient is advised to enter the hospital two days before operation. Liquid penicillin is instilled the night before operation.

American surgeons may be somewhat surprised that the method of corneal section with scissors for cataract extractions, now so popular in this country, is not mentioned except as an adjunct when too small a section is made with a cataract knife. In discussing corneoscleral sutures, the reader naturally expects a description of the Stallard suture but is surprised at the omission of the McLean. The important surgery of retinal detachment will be found to coincide very closely with that practiced in this country. The use of a long needle in cases of high detachment is advocated "so that its point reaches the retina, or nearly so, but does not pass through it." This sounds somewhat theoretical to the reviewer. The use of pinhole spectacles is advocated postoperatively,

but advice as to how long they are to be worn is missing.

A chapter is devoted to traumatic surgery, chiefly military. The posterior route for removal of intraocular foreign bodies in the vitreous is the method of choice according to Stallard, differing from the practice current in the First World War.

All in all this text seems sound and well presented. It is a good supplement to one's surgical library.

Lawrence T. Post.

ALTERATIONS DE LA RÉTINE EN RAPPORT AVEC LES AFFECTIONS GÉNÉRALES. By Paul Bonnet. Report presented to the Société Française d'Ophthalmologie, May 18, 1947.

The first volume of this most-praiseworthy atlas of ophthalmoscopy was reviewed in the March, 1947, issue of the JOURNAL. This second volume is no less interesting. It follows the same plan as its predecessor and is equally well printed. There are 253 pages of text with 41 illustrations. There are 83 beautiful, interesting, and instructive fundus drawings on 36 plates.

The lesions discussed are predominantly associated with disturbances of the hematopoietic system, namely, anemias, leukemias, angiomas, hemolytic icterus, Banti's disease, and a few less closely related syndromes.

F. H. Haessler

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

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| 1. General methods of diagnosis | 10. Retina and vitreous |
| 2. Therapeutics and operations | 11. Optic nerve and toxic amblyopias |
| 3. Physiologic optics, refraction, and color vision | 12. Visual tracts and centers |
| 4. Ocular movements | 13. Eyeball and orbit |
| 5. Conjunctiva | 14. Eyelids and lacrimal apparatus |
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| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries |
| 8. Glaucoma and ocular tension | 17. Systemic diseases and parasites |
| 9. Crystalline lens | 18. Hygiene, sociology, education, and history |
| | 19. Anatomy, embryology, and comparative ophthalmology |

7

- UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

- O'Donnell, J. M. Behcet's triple syndrome. *M. J. Australia*, 1947, June 14, pp. 730-732.

The author reports a case of Behcet's syndrome. The patient had small punched out ulcers of the scrotum and mouth, conjunctivitis, iritis, epididymitis, geographical tongue and gastric disturbances. High doses of ascorbic acid helped in the recovery.

Irwin E. Gaynon.

Rados, Andrew. Central pulverulent (discoid) cataract and its hereditary transmission. *Arch. of Ophth.*, 1947, v. 38, July, pp. 57-77.

The author gives a detailed description of this type of cataract (also known as Coppock or Doyne cataract) and analyzes the hereditary transmission. The family trees reported in this paper and the literature show that the mode of inheritance is dominant. (9 figures, 31 references.) R. W. Danielson.

Rio Cabanas, J. L. Bilateral metastatic pseudoglioma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, April, pp. 380-384.

An infant, 26 months of age, developed an acute febrile exanthema, with nephritis. The exact nature of the infection was not diagnosed, but it was probably a streptococcus septicemia. A few days after the onset of the disease both eyes developed symptoms of a violent uveitis with hypopyon, and soon afterwards a yellowish conglomerate mass resembling a glioma appeared in the vitreous of each eye. The diagnosis of a metastatic pseudoglioma was made, and the outcome was atrophy of one eye, and doubtful light perception in the other. It is believed that penicillin therapy prevented the development of a panophthalmitis. Ray K. Daily.

Solanés, M. P. The Vogt-Koyanagi syndrome. *Anales de la Soc. Mexicana de Oft.*, 1947, v. 5, Jan.-March, pp. 12-23.

The new cases of this disease now reported raise to nine the number

placed on record in Mexico. The ages of these two patients were respectively 25 and 28 years. The former was five and a half months pregnant.

The symptoms included various forms of uveitis; poliosis of the eyelashes, eyelids, and axillas; alopecia and vitiligo; hyperacusia, dysacusia, and deafness, in addition to general neuropathic and febrile manifestations.

Slow recovery of vision occurs, but the vision never returns to normal. Occasionally there is secondary glaucoma, or phthisis bulbi. (References.)

W. H. Crisp.

Stine, G. H. Detachment of the choroid and the retina. Anatomic and other considerations in the differential diagnosis. *Amer. Jour. Ophth.*, 1947, v. 30, July, pp. 897-907. (See Section 10, Retina and vitreous.)

Stocker, F. W. Experimental studies on the blood-aqueous barrier. *Arch. of Ophth.*, 1947, v. 37, May, pp. 583-590.

It has been demonstrated by numerous authors, especially by the splendid work of Duke-Elder and Friedenwald and their co-workers, that the penetration of the various constituents of aqueous through the blood-aqueous barrier follows a rather complicated scheme. Electric charge, size of the molecule and possibly other factors influence the ratio of transmission of each constituent. But, on the other hand, it has also been shown that any change of the permeability of the blood-aqueous barrier will affect all constituents to a certain extent, though not equally, whether they are electrolytes, nonelectrolytes or proteins.

There is little doubt that the permeability of the blood-aqueous barrier plays an important part in certain cases of glaucoma. It also is known and con-

firmed by the experiments in part II of this study that the drugs generally spoken of as miotics not only contract the pupil but also increase the permeability of the blood-aqueous barrier.

From this preliminary report, the following conclusions seem to emerge: (1) no appreciable influence on the permeability of the blood-aqueous barrier can be demonstrated when normal rabbits are fed large doses of rutin for three weeks, and (2) the action of physostigmine, which is known to increase the permeability of this barrier after being instilled into the conjunctival sac, is greatly reduced if the animal has been rutinized. (2 charts, 17 references.) R. W. Danielson.

Vanzetti, G., and Seidenari, R. The composition of the aqueous humor, particularly the glucose and chloride content. *Rassegna Ital. d'Ottal.*, 1947, v. 16, Jan.-Feb., pp. 65-77.

Chemical determinations by means of micromethods were made upon samples of 0.88 cc. of aqueous in a series of normal and pathologic eyes. Details of the procedure and results of individual determinations are given in the article. The average chloride content was found to be the same as that of the blood serum, 6.499 gm. per 1,000 cc. and of glucose 0.727 gm. The latter figure is sensibly lower than that given by Ash and less than the percentage in the blood. No appreciable change in the protein content was found. (2 tables, 19 references.) E. M. Blake.

Vianna, Louzada. Tuberculin therapy in the uveitides. *Rev. Brasileira de Oft.*, 1947, v. 5, June, pp. 195-207.

The author believes the following facts should be kept in mind in dealing with the possibility of a tuberculous

etiology: Tuberculous infection is the rule and its existence in the adult may be assumed. This disease in the eye may frequently take on the appearance of an ordinary inflammation without specific character. Tuberculin has curative action in certain tuberculous processes.

The author has studied 142 cases of endogenous affection of the uveal tract, in the past 18 months. Many had had antisyphilitic treatment and others were still undergoing such treatment. Eighteen cases are summarized as having supported the belief that improvement obtained was clearly associated with tuberculin therapy. The tuberculin is kept in dilutions running from 1 to 10 up to 1 to 1,000,000, which are in practice referred to as 1—zero up to 6—zero. (References.) W. H. Crisp.

Vidal, F., and Brodsky, M. Physiopathologic considerations concerning a case of post-traumatic anisocoria. *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Aug., p. 235.

After a gunshot wound of the neck, a patient presented an arteriovenous aneurysm of the left carotid artery, with exophthalmos, conjunctival hyperemia, marked vascular engorgement of the fundus and slight peripheral contraction of the nasal field of the same side. There was also ptosis of the upper lid and miosis due to a lesion of the cervical sympathetic fibers. Resection of the aneurysm brought about gradual improvement of the exophthalmos and vascular disturbances, but the ptosis and miosis remained unchanged. Pharmacologic tests confirmed the sympathetic nature of the latter condition. (Bibliography.)

Plinio Montalván.

Yasuna, E. R. Danger of penicillin

therapy in active uveitis. *Arch. of Ophth.*, 1947, v. 37, May, pp. 598-607.

A review of the literature of the use of penicillin in various eye diseases is followed by two case reports of uveitis in which the penicillin seemed to hinder rather than favor the healing process. The author explains this apparent action by mentioning the recent theories that uveitis is caused by bacterial toxins and products of bacterial degeneration rather than by the bacteria.

Thus destruction of the bacteria in the focus of infection could aggravate the uveitis.

He concludes that penicillin in the treatment of uveitis does not appear to offer any advantages over previous methods and may cause the uveitis to persist longer than it would otherwise. (41 references.) R. W. Danielson.

8

GLAUCOMA AND OCULAR TENSION

Baillart. Infantile glaucoma in a national institution for the young blind. *Ann. d'Ocul.*, 1947, v. 180, May, pp. 257-262.

This analysis of 40 patients with infantile glaucoma shows that the tension was surgically brought to normal in only half of those operated upon. Blindness is not only caused by increased ocular tension but also by subsequent atrophy. Twenty-three percent of the patients admitted between the ages of 8 and 18 years had infantile glaucoma. Boys were affected more frequently than girls in the ratio of five to three.

Only five percent of the total infantile glaucomas were due to congenital syphilis and an equal number occurred in children whose mothers had rubeola in the first months of pregnancy. In 17 percent of the cases the infantile

glaucoma was familial. Latent or actual hydrocephalus was associated in approximately 25 percent and buphthalmos existed with infantile glaucoma in 67 percent. Nine eyes had been enucleated before admission and 60 percent of the patients who had had surgical treatment were totally blind.

Chas. A. Bahn.

Bárány, Ernst. The influence of local arterial blood pressure on aqueous humor and intraocular pressure. An experimental study of the mechanism maintaining intraocular pressure. *Acta Opth.*, 1947, v. 25, pt. 1, pp. 81-94.

This second investigation in this field deals with the recovery of intraocular pressure, arterial blood pressure, and heat dissipation by the external ear after unilateral carotid ligation. The former investigation demonstrated that immediately after ligation the intraocular pressure maintains a constant level about 3.5 mm. below normal. The tabulated data of the results of the present study show that the intraocular pressure does not undergo any significant changes within the first 24 hours after ligation. During the following days a slight additional fall in blood pressure and intraocular pressure is followed by a return to normal. The intraocular pressure becomes normal more rapidly than the blood pressure. In some cases the intraocular pressure returns to normal, and the blood pressure remains considerably reduced. The difference in the progress of recovery of intraocular pressure and blood pressure is interpreted as an indication that the intraocular pressure has a defense mechanism against a fall in blood pressure, which enables the intraocular pressure to become normal in spite of a persistent and marked fall in blood pressure. The heat dissipation from the

external ears and the ear pressure behave like intraocular pressure. They recover much more rapidly than the blood pressure, and become normal simultaneously with the intraocular pressure. The similarity in the behavior of two completely different circulatory functions supports the view that the recovery of intraocular tension is due not to a slow acting regulation of the intraocular pressure, but to a general adaptation of the vascular bed to a low blood pressure. (7 graphs.)

Louis Daily, Jr.

Barkan, Otto. Cyclodialysis, multiple or single, with air injection—an operative technique for chronic glaucoma. *California Med.*, 1947, v. 67, Aug., pp. 78-83.

Cyclodialysis is indicated in primary glaucoma of the wide angle type, and is the operation of choice in cases of narrow angle glaucoma with peripheral adhesions. It is also indicated in certain types of secondary glaucoma, and in eyes in which other types of glaucoma operations have failed. In primary glaucoma the tension was normalized in 63 of 70 eyes. Of these 13 had the narrow angle type with peripheral adhesions, and all were normalized.

With the use of air injection immediately after the cyclodialysis, hemorrhage is controlled, the cleft is visible, and by restoring and deepening the anterior chamber, multiple cyclodialyses are made possible. Maximal miosis is maintained preoperatively and postoperatively, and a miotic is prescribed permanently to assure maintenance of the cleft and channel.

O. H. Ellis.

Barkan, Otto. Cyclodialysis, multiple or single, with air injection. *Amer. Jour. Opth.*, 1947, v. 30, Sept., pp. 1063-1073. (4 figures, 11 references.)

Barry Rodríguez, Julio. Complex forms of glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, June, pp. 576-585.

The importance of the investigation of glaucoma is stressed in all cases of optic nerve atrophy especially in those of unknown cause. The author reports the case of a 67-year-old man who for several years was thought to have a simple bilateral optic atrophy. The diagnosis of glaucoma was made by means of the measurement of ocular tension and visual fields.

J. Wesley McKinney.

Biozzi, Giuseppe. Cyclodiathermy-puncture. *Riv. di Oftalm.*, 1946, v. 1, Nov.-Dec., pp. 679-697.

Biozzi performed Vogt's operation on 31 patients. He used the original technique but extended the operative area over one half of the circumference, and applied 150 to 200 single punctures each time. The safety margin between doses that efficiently reduce pressure and dangerous hemorrhage is small. A current of 60 milliamperes was used. The author used cyclodiathermy puncture in 16 cases of chronic simple glaucoma, 12 of absolute glaucoma, 6 of glaucoma in aphacic eyes, 2 of secondary glaucoma, and one each of malignant, chronic irritative, and prodromal glaucoma. In the eyes with chronic simple glaucoma, the cyclodiathermy reduced the intraocular pressure ten times for a period of three to eight months, in three other eyes the period of postoperative observation was too short for conclusive classification, and in three a reduction of pressure lasted for about one month, when a second operation was followed by a pressure drop that lasted 2 and 10 months respectively. In three of the eyes with absolute glaucoma, the operation was

a failure, but the other eyes became painless and softer for at least some months. In two of the aphacic eyes, the pressure was controlled for 7 to 19 months; in one eye a second operation became necessary. The cyclodiathermy puncture may save some glaucomatous eyes that would otherwise be lost, and is indicated particularly after failure of other antiglaucoma operations. K. W. Ascher.

Bloomfield, Sylvan. Relative deficiency of parasympathomimetic activity in aqueous of eyes with chronic simple glaucoma. *Arch. of Ophth.*, 1947, v. 37, May, pp. 608-617.

The purpose of this investigation was to determine experimentally whether a parasympathomimetic substance actually occurred in the nonglaucomatous human eye and to determine its identity if present. A series of eyes with chronic simple glaucoma was also studied to explore the possibility that some deficiency in the normal activity of such a cholinergic substance occurred in that disease. Since the aqueous humor is, in a sense, a perfusion fluid of the eye, and, with proper precautions, is safely obtainable by paracentesis from the living organ, the study of that fluid seemed suited to this purpose. Because of the pharmacologic nature of this investigation and the extreme dilution of the substances which are studied, biologic methods of assay were employed.

In 17 of 20 nonglaucomatous eyes with various noninflammatory pathologic conditions, an appreciable parasympathomimetic effect was demonstrable in the aqueous humor.

In each of seven eyes in which the aqueous humor could be further studied, this cholinergic activity was found to be due to the presence of acetylcholine.

In 15 of 20 eyes in various stages of chronic simple glaucoma, no such parasympathomimetic activity could be demonstrated in the aqueous humor. In the remaining five eyes in this series, the intensity of the parasympathomimetic activity present was significantly lower than that which occurred in the aqueous of the 17 nonglaucomatous eyes which produced cholinergic effects.

This relative deficiency of parasympathomimetic activity of the aqueous humor in eyes with chronic simple glaucoma was not altered by the successful treatment of the disease with various filtering operations.

There is evidence that this relative deficiency in parasympathomimetic activity of the aqueous of eyes with chronic simple glaucoma is related to the faulty regulation of intraocular pressure which occurs in that disease. (8 references, 4 figures.)

R. W. Danielson.

Bloomfield, Sylvan, and Kellerman, Leo. The relative value of several diagnostic tests for chronic simple glaucoma. *Amer. Jour. Ophth.*, 1947, v. 30, July, pp. 869-877. (8 figures, 17 references.)

De Torres Lucena, M. Influence of atropine given intravenously on the ocular tension of primary glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, May, pp. 446-454.

This study was made on 62 patients with primary glaucoma, between the ages of 60 and 70 years. Intravenous injection of atropine sulphate in doses of 0.25, 0.50, and 0.75 mg. were given every six or seven minutes until the total amount reached was the amount given in the Vasquez-Danielopolu test. The ocular tension and pupillary measure-

ment were taken every 20 minutes in the first two hours and every hour thereafter until six were made. Hypotension was found in 34.1 percent, hypertension in 51.2 percent, and no deviation in 14.6 percent. All but three responded with mydriasis before the first two hours. In order to prevent a later hypertension, drops of 7-percent pilocarpine were given after the fifth hour.

J. Wesley McKinney.

Diaz Domínguez, Diego. Spontaneous healing of glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, May, pp. 455-467.

The author reports in detail three cases of chronic glaucoma which had healed spontaneously.

J. Wesley McKinney.

Dunphy, E. B. Di-isopropyl fluorophosphate in glaucoma. *Bull. New England Med. Center*, 1947, v. 9, June, pp. 102-106.

DFP is a powerful, toxic miotic. The miosis persists up to 14 days and is present under full dark adaptation. It acts by destroying cholinesterase and reduces the tension in glaucomatous and normal eyes. In one-half of the eyes with glaucoma which did not respond to pilocarpine or eserine, DFP succeeded in bringing the tension to normal. Its ontoward effects are pericorneal injection, congestive iritis, and, occasionally, an increased ocular tension.

Irwin E. Gaynon.

Gallenga, R. The operability of advanced chronic glaucoma. *Rassegna Ital. d'Ottal.*, July 1943-Dec. 1945, v. 12-14, pp. 516-528.

Gallenga urges surgery in all cases of chronic glaucoma, regardless of the duration of the disease or the state of the fields of vision. He favors the fis-

utilizing type of operation. When the tension is very high a cyclodialysis is added to the trephine operation. He agrees with Lauber that there is a relationship between ocular tension and general arterial pressure, and takes measures to raise the latter when it is below normal. When one cannot lower the tension and raise the blood pressure, operation results in decrease of vision and fields. The author gives a formula for prognosticating the results of surgery based on the ocular tension, the retinal arterial pressure and the general blood pressure.

Eugene M. Blake.

Granville, Roberto. *Goniodialysis*. *Rev. Brasileira de Oft.*, 1947, v. 5, June, pp. 231-235.

The author's operation for chronic glaucoma secondary to anterior synechia consists of making a scleral incision with the lance keratome or the Graefe knife, 2 mm. from the limbus and 4 mm. long; and then passing a spatula through this incision into the anterior chamber and sweeping the spatula along the angle of the chamber, first for a quarter of the limbal circumference to one side and then similarly to the other side of the primary incision. The spatula, maintained in intimate contact with the posterior face of the sclera, should not penetrate beneath the sclera more than 2 mm. from the limbus. Two successful and two unsuccessful cases are reported. (2 illustrations.)

W. H. Crisp.

Just Tiscornia, Benito. *Exploration of the functional status of the arterioles, capillaries, and veins of the anterior ocular segment*. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, April, pp. 367-374.

This is essentially a review of the

work of Vidal and Malbran on vasoscopy. Reference is made to Vidal and Malbran's conception of the role of the various components of the vascular system in the maintenance of ocular tension. The ocular tension of 100 mm. Hg found immediately after death is considered the static ocular tension produced by the fluid content of the interstitial tissues. The pressure above that is designated as dynamic, and attributed to active circulatory processes, in which the capillaries perform the most important function. In angiosclerosis involving the arterioles the ocular tension is low, but if the disturbance involves principally the veins the ocular tension rises.

The tests for the functional integrity of the ocular arterioles, capillaries, and veins are described in detail. For the study of the ocular arterioles, which are stimulated by the fibers of the sympathetic, 5-percent ephedrine sulphate solution is instilled into the conjunctival sac five times, at intervals of one minute. The ocular tension and size of the pupil are noted before the instillation, and 20 to 60 minutes afterwards. In normal persons and in advanced angiosclerosis there is no effect. In a disturbance of the venous circulation there is a rise in the ocular tension. In neuro-circulatory asthenia, with a diminished blood supply, there is a lowered ocular tension. The ocular circulation may be improved by conjunctival instillation of 2-percent ephedrine sulphate combined with calcium chloride. The capillary activity is under control of the parasympathetic system in which acetylcholine is the chemical intermediary. One can substitute carbaminoilcholine for acetylcholine by the instillation of a one third-percent solution preceded by a wetting agent; this instillation affects ocular tension through

capillary action. In patients with a normal circulatory apparatus there is a rise in tension for three to five minutes which is produced by increased arterial capillary activity. Following the short rise is a slow fall in tension lasting 50 minutes; this fall is ascribed to the increased activity of the veins, which carry away intraocular fluid more rapidly than it enters. About 80 minutes from the beginning of the test tension begins to return to normal, which it reaches at the end of three hours. In inadequate venous activity the secondary fall in tension does not take place.

Another test determines the cholesterinase content of the anterior ocular segment. A drop of 1.8-percent solution of dimethylcarbamic ester of bromide of oxipheniltrimethylammonia is instilled in conjunction with a wetting agent. Within eight minutes the tension rises 3 mm. because of increased arterial capillary activity. After two to three minutes the tension returns to normal, as a result of increased activity of the venous capillaries. Normally the effect of the drug is insignificant. In incipient glaucoma the effect manifests itself chiefly on the pupillary sphincter and ciliary muscle. In advanced glaucoma the secondary fall in tension does not occur. Vidal and Malbran believe that the first change in primary glaucoma is an increased cholesterinase content in tissues which contain it normally, such as the retina, the iris, and the ciliary body; later as its quantity increases, it is found in the aqueous and the vitreous which do not contain it normally. The increased cholesterinase content leads to the circulatory disturbances and ocular edema that characterize the glaucomatous syndrome. The tests of vascular function demonstrate metabolic changes in the anterior ocular segment.

Ray K. Daily.

Kalt, Marcel. Iridencleisis in the treatment of secondary glaucoma. *Arch. d'Opht.*, 1947, v. 7, no. 1, pp. 18-27.

Kalt reviews the surgical procedures which have been used in glaucoma secondary to iridocyclitis and concludes that repeated paracentesis, iridectomy, cyclodialysis, and the corneoscleral trephine are inefficacious. He advocates iridencleisis, performed according to the method of Weekers, as the surgical procedure of choice. In 22 cases of iridocyclitis with secondary glaucoma he was able to control tension in 86 percent. In 60 percent of the cases there was an improvement in vision and in 50 percent of the cases the preoperative visual fields were maintained.

Phillips Thygeson.

Magitot, A. Thalamus and glaucoma. *Ann. d'Ocul.*, 1947, v. 180, Jan., pp. 1-9.

After 60 years of research, glaucoma continues to be ophthalmology's enemy number one. Due to the emphasis of corneoscleral filterability by the Heidelberg School, the vascular factor in glaucoma has been neglected. This factor largely determines the response of the individual eye to intraocular tension. As it is the intraocular venous pressure and not the arterial that is about proportionate to the intraocular tension, the vascular process is apparently primarily venous. The genetic degeneration of the intraocular vascular system is only part of a similar condition elsewhere in the body, as has been demonstrated by subungual capillaroscopic tests. Especially the metabolism of water and acetylcholine is involved. The frequent association of glaucoma with endocrine disturbances, especially those of the pituitary gland, is thus explained. Eyes structurally predisposed to glaucoma are hypersen-

sitive to sympathetic and parasympathetic stimuli in which the ductless glands play an important part. Bodily vascular hypersensitivity is closely associated with that of some of the diencephalic centers especially those in the thalamus. Here sensory perceptual and other stimuli are integrated into autonomic vascular responses with their attendant production of sympathetic, acetylcholine and related substances. This thalamic hypersensitivity which is partly vascular helps us to better understand why pain and emotion, febrile intoxications such as epidemic dropsy, and the use of caffeine may precipitate or aggravate glaucoma.

The treatment of glaucoma is based chiefly upon the use of drugs which alter autonomic vascular function. Decompressing operations alone do not eliminate this vascular factor and therefore do not cure glaucoma. The psychoneurologic treatment as an adjunct to other means is becoming increasingly important. It is important in this treatment to make the patient realize that if he remains calm he increases the chance to avoid his potential blindness.

Chas. A. Bahn.

Malbrán, J. L., and Caretti, J. A. Glaucoma: early diagnosis. The vacuum cup test. *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Oct.-Nov., p. 315.

The authors studied the value of the vacuum cup test of Werner Herzau as applied by Abreu Fialho to the early diagnosis of glaucoma. The vacuum cup is made of plastic material and is connected to a rubber bulb for the production of a vacuum. It is placed over the cornea of the eye under study and the vacuum is maintained for a period of five minutes, after which the behavior of the intraocular tension is studied with the tonometer. In normal

eyes there is a drop in tension immediately after the test to half or less of the original. The period of recovery lasts from 5 to 15 minutes during which the tension returns to the initial level, but never above it. In eyes with a very delicate conjunctiva, bulbar hemorrhages and edema may occur after the test and disappear in three to five days. After studying this test in normal and preglaucomatous eyes the authors conclude that any eye whose tension does not behave in the characteristic manner, must be considered as suspicious of preglaucoma. Eyes must be also considered as suspicious of preglaucoma when the tension falls, but recovers in five minutes or less, or if after the recovery, the tension climbs 10 mm. or more higher than the original figure.

The vacuum cup test is a valuable adjunct in the diagnosis of preglaucoma, but is not conclusive as a sole procedure. Its mechanism is unknown and Abreu Fialho advanced the theory that the neurovegetative nervous system is an important factor in it. No untoward effects have been observed after the test. (1 illustration, charts, bibliography.) Plinio Montalván.

Marlow, S. B. Field of vision in chronic glaucoma. *Arch. of Ophth.*, 1947, v. 38, July, pp. 43-56.

In 1931, observations on 11 cases of chronic glaucoma showing the effect of reduced illumination on the field of vision were reported by the author. The present review has to do with 50 additional cases studied by the same method. Marlow concludes that the necessity for control of the illumination in examination of fields of vision in cases of chronic glaucoma would seem obvious; yet too little attention has been directed to it. The amount of light available should be recorded, whether

natural daylight or artificial illumination is used. The value of reduced light in demonstrating early field defects characteristic of glaucoma in what Traquair calls the preperimetric stage of the disease is suggested by the charts and the analysis of the cases studied. Ferree and Rand have used 7 foot candles in their perimeter and tangent screen, but in this study 0.02 foot candle was selected. (13 charts.)

R. W. Danielson.

Morano, M. **Glaucomatous changes of the lens.** *Boll. d'Ocul.*, 1946, v. 25, July-Sept., pp. 359-380. (See Section 9, Crystalline lens.)

Morano, M. **The physiologic action of prostigmin.** *Rassegna Ital. d'Ottal.*, July 1943-Dec. 1945, v. 12-14, pp. 468-503.

The author experimented with prostigmine intravenously and orally in normal and glaucomatous eyes. Administered parenterally, prostigmine causes miosis in normal eyes and in those in which adrenalin had been instilled, but has no effect upon atropinized eyes. The drug is effective especially in glaucoma complicated by vascular changes in the fundus, even in the post-thrombotic type.

The intravenous use of prostigmine lowers the general blood pressure, and, therefore that of the retinal circulation, and has proved beneficial in embolism of the central retinal artery. According to Morano a 1-percent solution of prostigmine is as equally effective as a 1-percent solution of eserine or 3-percent pilocarpine. Eugene M. Blake.

Moreu, Angel. **Experience with goniotrabeculotomy and gonioscyclothermy.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, May, pp. 468-478.

The author thought that better results could be obtained in glaucoma by combining the cyclopuncture diathermy of Vogt and the goniotrabeculotomy of Barkan. Instead of using the Ziegler's knife he used a diathermic needle which is easier to manage. The scar left by this procedure is softer and more flexible, the hemorrhage is eliminated and the occurrence of infection is minimal. The operation can be repeated if it becomes necessary. A series of four cases is reported. From this study the author concludes that the proper selection of suitable cases is important. Eyes with absolute glaucoma and a narrow angle or with peripheral total synechia do not respond well. Glaucoma with wide angle and edematous zones of the ciliary body responds favorably. Intraocular hypertension follows the operation. This may last for 24 hours and is followed by lowering of the tension. It is not recommended to do more than six punctures, because sometimes it is necessary to operate again. The pupil must be in miosis and the use of miotics must be continued for the first 48 hours after the operation. Postoperative medical therapy is always necessary.

J. Wesley McKinney.

Moreu, Angel. **The mechanism of action of antiglaucomatous operations.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, May, pp. 479-486.

The author states that there are antiglaucomatous operations which are very useful even though no fistulization is produced and the drainage is not increased. Such operations are iridectomy, cyclodialysis, diathermic punctures, gonioscyclothermy and goniotrabeculotomy. It has been proved many times by means of gonioscopy that iridectomy does not free the iridocorneal angle. The same results have

been obtained by performing sphincterectomy which conserves the iris root. The cyclodialysis does not make either a tunnel or a fistula. A short time after the operation is performed the tunnel is obliterated by a small blood clot and the ciliary body is firmly joined to the sclera which sometimes gives an evident peripheral synechia. Everybody agrees that diathermic punctures and gonioscyclodiathermy do not produce any drainage. Barkan says that goniotrabeculotomy would serve for opening the sclerosed wall of Schlemm's canal but the author repeats that in this type of operation the opening will close after a short period just as in cyclodialysis. Sometimes fistulization operations have been performed in which no filtration bleb has been observed. However, the tension of the glaucoma has been controlled. Undoubtedly these operations act upon glaucoma by a more complex mechanism than the mere establishment of drainage. The author agrees that all antiglaucomatous operations have a common mode of action; they act directly on the ciliary body by modifying its innervation or vascularization, and indirectly on the eyeball. He concludes that postoperative medical therapy is always necessary for the success of surgical treatment.

J. Wesley McKinney.

Shaffer, R. N. Inverse cyclodialysis. *Amer. Jour. Ophth.*, 1947, v. 30, July, pp. 860-868. (11 figures, 1 table, 11 references.)

Sugar, H. Saul. Cyclodialysis: a follow-up study. *Amer. Jour. Ophth.*, 1947, v. 30, July, pp. 843-859. (2 tables, 3 charts, 55 references.)

Thomassen. Thore Lie. Experimental investigations into the condi-

tions of tension in normal eyes and in simple glaucoma, particularly performed by subjecting the eyes to weight compressions. *Acta. Ophth.*, 1946, Supplement 27.

This monograph is a review of the literature on the effect of compression or massage on the normal and glaucomatous eye, and a report of an exhaustive experimental investigation. In this study compression was produced by Baillart's ophthalmo-dynamometer, placed on the limbus temporal to the cornea, and the tension measured by the Schiøtz tonometer, before compression, and 5, 15, and 35 minutes after compression. A compression of 25 gm. for 2 minutes, and of 150 gm. for 2 to 6 minutes was used in most experiments. During the compression there is a fall in tension, attributed to the forcing out of aqueous from the eye, through the canal of Schlemm. After the removal of compression the tension gradually returns to its initial level, and in some cases it continues to rise, producing a so-called relative hypertension. The latter is believed to be a reaction to the irritation of the compression, acting through the innervation of the ocular vessels, in the form of an increased blood volume, or an increased capillary tone with augmented secretion of aqueous. The result is an increased fluid content of the eyeball. The occurrence of relative hypertension in some eyes, and not in others, is explained by the varying faculty of eyes to compensate the effect of the compression. The extent of this power of compensation may be determined by finding the weight of compression required to produce a relative hypertension. The greater compression an eye can bear without producing a relative hypertension, the greater should be its power of compensation. The data show that

the power of compensation diminishes considerably with age, and is completely lost in glaucoma before the tension rises.

In this study all normal eyes withstood a compression of 150 gm. for 2 minutes without developing a relative hypertension, and this degree of compression is therefore taken as the minimum power of compensation for normal eyes. The extent of the fall in tension following compression varies, but is not affected by age. Homatropine reduces the fall during a compression, and pilocarpine increases it. Homatropine also reduces the compensating power of the eye, while pilocarpine augments it. In glaucomatous eyes the power of compensation is greatly reduced, and a relative hypertension may be produced by a compression of 25 gm. for 2 minutes; the result however, is greatly influenced by the phase of ocular tension during which the compression is performed. With compression performed in an increasing phase of ocular tension the fall in tension is small, and the relative hypertension high; in a decreasing phase of ocular tension the compression produces a marked fall in tension and no relative hypertension. This phenomenon was not discovered during former investigations, and accounts, the author believes, for the disparity of reported data. It is explained by the difference in the tension of the intrascleral veins. In an increasing phase of ocular tension, the tension in the intrascleral veins is high and the escape of fluid through Schlemm's canal is blocked. In a decreasing phase the tension in the intrascleral veins is low and the escape through Schlemm's canal becomes easy.

An attempt is made to apply the data obtained in this study to the clarification

of some of the glaucoma problems. The author finds that the data indicate that pathogenetically there are two forms of increased ocular tension. In one the tension rises as a result of a change in the ratio between the volume and the contents of the eyeball, such as is produced by pressing the eyelids together; in this form there is no increase in the tension of the ocular capillaries, and the rise in tension is compensated by the escape of aqueous through Schlemm's canal. The second form of increased intraocular pressure is due to a primary increase in the capillary tension, and can not be compensated by aqueous escape through Schlemm's canal. The increased ocular tension in glaucoma, as well as that produced by the provocative tests is of this type. Application of the data to the explanation of the regular oscillation in ocular tension suggests that the changes are due to corresponding changes in the tension of the ocular capillaries, stemming from rhythmical oscillations in a nervous impulse that originates in the central nervous system.

Clinically the use of compression as a provocative test is reliable only when it indicates an increased ocular tension. No fall in tension after compression is indicative of glaucoma. The occurrence of relative hypertension following compression of 25 gm. for 2 minutes is strongly suggestive of glaucoma. A relative hypertension following compression of 150 gm. for 2 minutes suggests the possibility of glaucoma. A negative test is of no value and carries no assurance of normal tension, because the test will also be negative in glaucoma in a decreasing phase of ocular tension. Compression may also be used as an aid in the evaluation of therapy. An eye with a poor power of

compensation should be kept under the influence of miotics even if the tension appears normal. Effective treatment with miotics should produce some power of compensation, and the compression test can be used to determine the required frequency of instillation of miotics. Compression with 25 gm. for 2 minutes is adequate for this test; if there is no relative hypertension after this compression, the therapeutic effect on the ocular tension can be regarded as satisfactory. Ray K. Daily.

Torres Lucena. Clinical contribution to the knowledge of the etiopathogenesis of primary glaucoma. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, March, pp. 265-287.

A study of 72 cases of primary glaucoma convinced the author that liver disturbances do not play any role in the pathogenesis of primary glaucoma. (90 references.)

J. Wesley McKinney.

Vila Ortiz, J. M. Intraocular tension and its influence in the appearance of retinal hemorrhages in diabetic patients. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, March, pp. 288-298.

Fifty-one of 99 diabetic patients did not show retinal hemorrhage. Hypotension was found in 22.5 percent of the patients without retinal hemorrhage and 38.5 percent of those who had retinal hemorrhages. The author concludes that diabetic patients generally have a relatively low ocular tension and the incidence of low tension is higher in patients with retinal hemorrhages.

J. Wesley McKinney.

Vidal, F., Malbrán, J. L., and Garcia Badaracco, J. Experimental acute intraocular hypertension. *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Aug., p. 227.

In normal cats under sodium pentobarbital anesthesia given intraperitoneally, the instillation of a 0.33-percent solution of carbaminoylcholine chloride in the eye produces, after a brief initial fall, a very marked increase in the intraocular pressure. (Charts, bibliography.) Plinio Montalvan.

9

CRYSTALLINE LENS

Cantonnet, F. Critical study of the incision in cataract extraction. *Ann. d'Ocul.*, 1946, v. 179, Dec., pp. 607-622.

The relative merits of cataract incisions made with the Graefe knife and keratome enlarged with scissors are analyzed in a series of 180 operations. The former was used in 106 cases, and the latter in 74. The complications which occurred at the time of incision are statistically analysed. The chief advantage of the keratome incision is that it can always be placed precisely in the limbus. Delayed healing occurred in 10 percent of the eyes opened with a Graefe knife and in four percent of those incised with a keratome. After six weeks the average amount of post-operative astigmatism as measured with a keratome was: Graefe, 3 diopters, keratome, 2 diopters.

Chas. A. Bahn.

Cristini, G. The fluorescence of normal and cataractous lenses. *Ophthalmologica*, 1947, v. 113, March, pp. 156-164.

Helmholtz was the first (1855) to observe and describe the phenomenon of fluorescence of the crystalline lens. The studies of F. P. Fischer (1934-1935) suggested a relationship between cataract formation and photolytic destruction of the so-called flavines of the lens substances related to vitamin B₂.

The fluorescence phenomenon seemed to be dependent upon the presence of those flavines. For that reason Cristini reinvestigated the fluorescence phenomenon. Cataractous human lenses obtained by intracapsular extraction or clear human lenses from eyes enucleated because of tumors of the sclera, were placed in the path of ultraviolet light obtained from an arc lamp; the rays transmitted and emitted by these lenses were analyzed qualitatively and quantitatively by means of a photometer. The behavior of clear and cataractous lenses was qualitatively the same: the lenses emitted a band of visible rays extending from 501 to 514 millimicrons. Brightness and saturation of this spectral band varied somewhat depending upon the type and stage of the cataract. Lens extracts prepared with water, methyl alcohol or chloroform, showed the same fluorescence phenomenon as whole lenses. These results indicated that the fluorescence of the lens was not dependent upon the physical arrangement of the particles within the lens but upon one or several chemical compounds, present both in clear and cataractous lenses. Exposure of the alkalinized extracts to large doses of ultraviolet light caused only a slight change of the fluorescence which proves that the substance causing the fluorescence is not a flavine, but probably a halloxazine substance. The question now arises: What is the relation of the latter substance to the respiratory enzyme system or to any of the metabolically important constituents of the lens?

Peter C. Kronfeld.

Johnstone, I. L. **Familial cataract with extensive pedigree chart.** *Brit. Jour. Ophth.*, 1947, v. 31, July, pp. 385-395.

Five generations of two branches of a family were studied with respect to a strongly persistent familial cataract. In all other respects the people studied were quite healthy and free from other developmental defects. Blood chemistry studies also showed no irregularities. One family branch consisted of 73 persons, 36 male and 37 female. The other branch included 58 persons, 28 male and 28 female (the sex of two members was unknown). Of these 58, 6 males and 11 females were affected. About 31 percent of the members were affected. Sex differences were insignificant. The disease was passed on by affected persons only and is therefore a Mendelian dominant characteristic.

The cataract itself was so characteristic that a person possessing it could be positively identified as a member of the family by examination of the eyes. It was a presenile, posterior, sub-capsular, saucer-shaped opacity which had leaf or feather-like radiations extending from its center, had flakes or dots of various colors, and caused an accentuation of the shagreen of the anterior capsule. It was always bilateral.

Morris Kaplan.

Knapp, Arnold. **Present state of the intracapsular cataract operation.** *Arch. of Ophth.*, 1947, v. 38, July, pp. 1-38.

This excellent paper combines a complete review of the literature and the author's opinions derived from his wide surgical experience. Anatomy, histology, techniques, accessory steps, instruments, complications, advantages and disadvantages are discussed in detail. (77 references.) R. W. Danielson.

Lee, O. S., Jr. **Corneoscleral suture in operations for cataract.** *Arch. of Ophth.*, 1947, v. 37, May, pp. 591-597.

The use of sutures for closure of incisions in cataract operations is one of the most useful and valuable refinements in ophthalmic surgery.

Ophthalmic surgeons do not all agree, however, that sutures aid in reducing the incidence of postoperative hemorrhage into the anterior chamber. Older writers were of the opinion that the bleeding came from the iris. More recent investigations, however, point to the incision as the source of hemorrhage. Any separation of the lips of the wound tears these vessels, and results in bleeding under the conjunctiva or, more frequently, into the anterior chamber.

For the past fifteen years it has been a routine procedure to employ three or more interrupted limbic-episcleral sutures for the closure of incisions in operations for cataract. In 1945 Lee and his associates began to use a modified Liegard suture placed in the 12 o'clock position on the limbus before the incision with the keratome was made, with two additional limbic-episcleral sutures placed on each side of it after extraction of the cataract. The use of this suture has reduced the incidence of hemorrhage into the anterior chamber in cataract extractions from 15.3 percent, when interrupted limbic-episcleral sutures alone were used, to only 6.6 percent, when the Liegard suture was added. When hemorrhages did occur, they were usually less extensive. (12 references, 1 illustration.) R. W. Danielson.

Morano, M. Glaucomatous changes of the lens. *Boll. d'Ocul.*, 1946, v. 25, July-Sept., pp. 359-380.

Lens changes are described in 14 eyes examined biomicroscopically in patients affected by glaucoma in its differ-

ent forms before and after antiglaucomatous surgical procedures had been performed. Aside from exfoliation of the anterior capsule and the acute subepithelial disseminated cataract of Vogt, a third kind of lens change was differentiated. This is the "glaucomatous cataract", which manifests itself as a posterior complicated cataract in primary glaucoma. One of the most important characteristics of the last type of cataract is the deterioration of vision after a surgical procedure. The writer advises examination of the lens with the slitlamp and dilatation of the pupil with adrenaline before attempting a decompressive operation so that the patient may be informed in cases of posterior complicated cataract that deterioration of vision may follow the operation. (Bibliography.)

Melchior Lombardo.

Moretti, Ezio. Subluxation of the lens into the anterior chamber in the treatment of total congenital cataract. *Boll. d'Ocul.*, 1946, v. 25, July-Sept., pp. 402-406.

In the course of the dissection of a congenital hard cataract in an infant the capsule was not penetrated by the knife-needle but manipulation of the instrument provoked a partial luxation of the lens into the anterior chamber. The lens was absorbed some time later. It is assumed that in attempting to penetrate the capsule of the lens the zonula was broken and a tear in the posterior capsule was made through which the lens matter was absorbed by the aqueous. Because of the good result the procedure was purposely repeated in the other eye.

Melchior Lombardo.

Owens, W. C., and Hughes, W. F., Jr. Intraocular hemorrhage in cataract

extraction. *Arch. of Ophth.*, 1947, v. 37, May, pp. 561-571.

The authors have reviewed 2,086 extractions of uncomplicated senile cataract performed at the Wilmer Ophthalmological Institute.

In order to determine what factors in the patient's general physical status might predispose to the occurrence of postoperative hemorrhage into the anterior chamber, the cases were analyzed from the following standpoints: (1) age, (2) blood pressure, (3) blood-clotting mechanisms, (4) diabetes, (5) syphilis and (6) foci of infection.

The authors concluded that except for severe diabetes, the general systemic condition of the patient is unrelated to postoperative hemorrhage into the anterior chamber. Operative techniques promoting firm closure and avascular healing of the incision reduced the incidence of this complication. These techniques include the use of two corneoscleral sutures and a shallow section. The visual results were significantly poorer in the eyes with postoperative hemorrhage into the anterior chamber than in those without hemorrhage. This was chiefly due to persistent opacities in the vitreous. (15 tables, 6 references.)

R. W. Danielson.

Pérez Llorca, J. Simplification of suction extraction of senile cataract. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, April, pp. 384-389.

Pérez Llorca ascribes the lack of popularity of suction extraction to the need of complicated and expensive apparatus. He designed a simple device, consisting of a canula, with a suction cup at one end, and a rubber tip, similar to that used on a medicine dropper at the other. His experience indicates that

the suction produced by the rubber tip is quite adequate to tumble and extract the lens. (3 illustrations.)

Ray K. Daily.

Rivas Cherif, Manuel de. The voluntary complications of the cataract operation. *Anales de la Soc. Mexicana de Oft.*, 1947, v. 21, April-June, pp. 60-88.

This paper was previously published in *Archivos Medicos Mexicanos* (1946, February) and is referred to in some detail in an editorial in the *American Journal of Ophthalmology* (1946, v. 29, p. 1594) and also under "Correspondence" on page 501 of the April, 1947, issue of the *Journal*. (Bibliography.)

W. H. Crisp.

Sánchez Mosquera, M. The use of penicillin as a preventive measure in cataract operation. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, Jan., pp. 48-51.

The author recommends the use of penicillin before cataract operation, especially when some infection is suspected. Penicillin is given intramuscularly, starting 12 hours before the operation and continuing six hours after. The dose is 20,000 units every three hours. He reports seven cases in which good results were obtained.

J. Wesley McKinney.

Ventola, V., and Iribarren, F. Retinal detachment. Pregnancy and ectopia lentis. *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Aug., p. 232.

A patient with congenital ectopia lentis presented in the sixth month of pregnancy a retinal detachment in the right eye. No tear could be found and the fundus of the left eye was normal. In view of the ectopia lentis and the possible etiologic relationship between the detachment and the pregnancy, no

surgery was performed. The final outcome is not reported.

Plinio Montalván.

10

RETINA AND VITREOUS

Aguilar Muñoz, José. Recurrent edema of the macula (retinitis centralis serosa). *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, June, pp. 586-588.

A man 50 years of age had edema of the right macula three times within three years. On general examination only arterial hypertension was found and it was thought that the edema was due to the metabolic changes brought about by the arterial hypertension. In spite of the recurrence the outcome was favorable. J. Wesley McKinney.

Alvarz Luna, Rogelio. Berlin's edema and hole of the macula. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, March, pp. 221-225.

The literature concerning the pathogenesis of Berlin's edema is briefly reviewed. A case of a young boy is reported, who suffered a traumatic injury to one of his eyes. The anterior chamber was completely filled with blood and when this disappeared the ocular fundus showed a small pigmented dot in the fovea, which diminished the vision to perception of hand movements at 20 cm. Later he developed a hole in the macula. J. Wesley McKinney.

Appelmans, M. Pseudo-albuminuric stellate retinopathy in a patient with paraganglioma. *Arch. d'Oft.*, 1946, v. 6, no. 4, pp. 448-455.

The author describes the case of a man, aged 30 years, who for six weeks had suffered from a great loss in vision. Ophthalmoscopic examination revealed a macular figure with hemorrhages and

edema of the nerve head and surrounding tissues. The arteries were contracted and the veins dilated. General examination revealed a hypertension and a slight albuminuria. Kidney function was normal but an abdominal tumor in the left upper quadrant was noted. Surgical removal yielded a heavily vascularized tumor situated under the renal hilus. Histopathologic examination revealed a non-encapsulated paraganglioma. Within a few days after removal of the tumor the hypertension had diminished, the vision was markedly improved, and the papilledema had disappeared. The macular star, however, persisted for several months. Vision returned to normal in each eye. Subsequently the tumor recurred and, in spite of radiotherapy, progressed. Six years after the surgical intervention the tumor had infiltrated widely although without metastasis. The retina showed no new involvement and visual acuity remained normal.

The author concludes that the pseudo-albuminuric retinopathy was the direct result of this endocrine tumor derived from embryonic sympathetic-system cells. The paroxysmal hypertension with intense headache and pulsation in the eyes was considered to be characteristic of hyperadrenalinism. The resultant angiospasm was assumed to be the cause of the retinal lesion because removal of the tumor caused disappearance of both the hypertension and the retinopathy. Phillips Thygeson.

Arcuri, D. Retinal detachment in pregnancy. *Rassegna Ital. d'Ottal.*, July 1943-Dec. 1945, v. 12-14, pp. 275-300.

Three cases of retinal separation that occurred in the sixth, seventh and the eighth month of pregnancy are reported. Two were bilateral, and spon-

taneous reattachment took place in all three. The detachments persisted for from 12 to 20 days.

After thoroughly reviewing the literature the author points out the differences between the clinical picture, the pathogenesis, the course, prognosis and therapy in the separations in pregnancy and in the other forms. Although retinal reattachment occurs without treatment, the prognosis as to vision is not always good. Renal insufficiency of the mother is the most important cause. The detachment may be associated with acute or chronic nephritis and neuroretinitis. (5 colored pictures.)

Eugene M. Blake.

Barrenechea, S., and Contardo, R. Roentgen therapy of retinal venous thrombosis. *Arch. Chilenos de Oft.*, 1946, v. 2, July-Oct., pp. 235-241.

The cases reviewed by the author include eleven of thrombosis of a branch, and ten of thrombosis of the central vein of the retina. The etiology was usually arteriosclerosis and the age of the patients varied between 42 and 74 years. Fractional doses of X ray were used, reaching a total of 550 r in thrombosis of the central vein. The initial dose was 100 r. The cases are tabulated in detail, to support the authors' impression that X-ray treatment was beneficial. (References.)

W. H. Crisp.

Belmonte González, Nicholas. Retinal arteriovenous index. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, May, pp. 442-445.

The diameter of the retinal arteries and veins is very difficult to measure and the percentage of error is very great. The author recommends finding the relation of the diameter between arteries and veins by means of the enlargement of the fundus picture. This

method permits the measurement of the vessels in tenths of millimeters. He found that normally the arteriovenous index is between 0.70 and 0.90. The application of this method is valuable for the early diagnosis and prognosis of hypertensive retinopathy. Several cases are reported with illustrations.

J. Wesley McKinney.

Belmonte González, Nicolas. A contribution to the study of experimental hypertensive retinopathy. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, March, pp. 213-220.

This experimental work was done on dogs, whose fundi were carefully observed. Fifteen to eighteen months before the observations, the dogs had hypertension with a range between 160 and 200 mm. Hg, whereas 120 mm. is normal. They did not show alteration in the urine nor elevation of the urea in the blood. The disturbances observed in the fundus consisted of tortuosity of the vessels, disturbances at the arteriovenous crossing, thickening of the arterial walls and rarely hemorrhages. In the dog, an experimental chronic nephrogenous arterial hypertension produces a fundus picture similar to that of essential hypertension in man. Complete renal insufficiency provoked by bilateral nephrectomy does not produce elevation of the blood pressure, and does not give any retinal disturbance. The tightening of both ureters produces in the fundus the alterations of function necessary to produce angiospastic retinitis. (Colored illustrations.)

J. Wesley McKinney.

Campos, R. The respiration and glycolysis of the retina after section of the optic nerve. *Rassegna Ital. d'Ottal.*, 1947, v. 16, May-June, pp. 169-185.

The optic nerve of the rabbit was cut across within the orbit in a manner

which left the central retinal and long ciliary vessels intact. The respiration of the retina was then measured in Ring-er's solution by the Wardburg method, direct and indirect. In the same way the aerobic and anaerobic glycolysis was measured at various periods of time after the section of the nerve. Tests demonstrated that the metabolism of the retina maintains its characteristics even five months after the nerve has been cut. At this time the ganglion cells are completely degenerated, as shown by the histological study of the retina. (2 figures.) Eugene M. Blake.

Cerboni, F. C., and Malamud, B. Concerning three cases of asteroid bodies in the vitreous. *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Aug., p. 213.

The authors present three cases of asteroid bodies in the vitreous. Two of the patients had normal vision and the other had senile lens opacities which lowered the visual acuity. There was no intraocular disease in any of the eyes. The condition is briefly discussed, with special emphasis on the differential diagnosis. (Illustrations, bibliography.) Plinio Montalván.

Dejean, C., and Laporte, P. Some clinical manifestations of tuberculous macular retinitis. *Arch. d'Ophth.*, 1946, v. 6, no. 4, pp. 397-412.

The authors describe four morphologic types of tuberculous involvement of the macula. The first type has been described under the name "solitary tubercle of the macula" and is characterized by cotton-wool exudates in the macular region. There is definite swelling associated with it. The condition persists for weeks and months and can develop into retinitis proliferans, or can become absorbed, leaving a large area of chorioretinal atrophy.

The second type, known as central

serous retinitis, is characterized by an intense macular edema, leading to the formation of a hemispheric bulla or a sort of serous cyst. The retinal vessels undergo a sharp bend when they reach the edge of the bulla. The evolution of this condition is described as being sluggish, often prolonged over several years and leading finally to an atrophy of the macula. It is often accompanied by vague ocular, orbital, and periorbital pain, tearing, and sometimes mild hypertony.

A third clinical type, known as brown macular retinitis, is not well known but is nevertheless of relatively frequent occurrence. It was noted particularly in prisoners of war returning from Germany. It is characterized by a brick red or brownish coloration of the macular region with an irregular and roughened appearance but with conservation of the foveal reflex. There is sometimes an alveolar appearance surrounding the fovea. The condition is described as evolving in four successive stages: (1) the brick red plaque stage, (2) the roughened brown plaque stage, (3) the brown alveoli or nodule stage, and (4) the black pigmentation stage.

The fourth type, known as radiating retinitis, is characterized by numerous whitish lines which diverge from the macula like the rays of the sun. The authors conclude that the ophthalmoscopic picture of this type is diagnostic.

The report is terminated by a discussion of etiology and therapy in which the authors express their regret that they were unable to control their studies by anatomical, bacteriological, and serological tests. They believe that a significant response to tuberculin therapy in these cases is evidence in favor of a tuberculous etiology.

The article is beautifully illustrated with eight drawings in color.

Phillips Thygeson.

Jimenez Ruiz. Retinitis proliferans and tuberculosis. Arch. de la Soc. Oft. Hisp.-Amer., 1947, v. 7, March, pp. 226-233.

Two adult men had recurrent hemorrhages in the vitreous in the year before the examination. The fundus showed the classic picture of retinitis proliferans. The origin of the retinitis was said to be tuberculosis and in one of them Koch's bacillus was found in the sputum. J. Wesley McKinney.

Haridas, G. Waren Tay-Sachs disease in a Chinese infant. Brit. Jour. Ophth., 1947, v. 31, July, pp. 428-436.

This typical case of amaurotic family idiocy is presented because it is the first case of this disease ever observed in Malaya. Its occurrence in a non-Jew is of interest because it is widely believed that the disease is entirely racial. The infant, 13 months of age, was seen because of convulsions. Of his family history nothing could be learned since the parents never returned after the baby's admission. The child was blind, suffered progressive hydrocephalus, paralysis of all limbs and severe muscular wasting. Funduscopy revealed marked pallor of both discs and a purple-red macular spot on a milky white background in each eye. He died at the age of 20 months and 20 days of terminal lobar pneumonia. Autopsy report was not available.

Morris Kaplan.

Kettesy, A. Technical improvements in the diathermy operation for detachment of the retina. Brit. Jour. Ophth., 1947, v. 31, July, pp. 436-441.

The author expresses much dissatisfaction with the two types of coagulation treatment available. The perforating needle leaves the eye too soft and the sclera too wet for satisfactory tech-

nique and the Safar pins are awkward to hold in the forceps and are much too easily dislodged while further insertions are being made. He describes a new pin and forceps which has given him much satisfaction during the last three years. The pin is made of polished stainless steel with a round, flat head 0.3 mm. thick and 1.5 mm. in diameter. The length varies from 2 to 6 mm. It is cylindrical with a sharp conical point. The forceps is angular with grooves along three margins of the ends into which the pins fit securely. During the operation the pins are kept in flat cork plates. On a wood or plastic model of an eye made twice normal size, the procedures are sketched and planned carefully before each operation. The tear and the area of detachment are outlined. The longer pins, used for localization, are carefully watched with the ophthalmoscope and the shorter ones are used for the actual coagulation. (7 diagrams.) Morris Kaplan.

MacLean, A. L., and Brambel, C. E. Dicumarol and rutin in retinal vascular disorders. Amer. Jour. Ophth., 1947, v. 30, Sept., pp. 1093-1108. (1 table, 6 figures, 19 references.)

Magitot, A. Clinical electrical retinography. Ann. d'Ocul., 1947, v. 180, March, pp. 169-177.

The electroretinogram resembles the electrocardiogram in graphically electrically expressing organ function. The necessary apparatus consists of an illuminating and receiving-recording unit. The former includes an electric filament source, condensers, diaphragms, a rotary shutter, a tilted mirror, and a distance adjustment mechanism, all encased and suspended from a wall bracket. The recording unit consists of a contact glass electrode con-

nected by means of a head band, with a delicate galvanometer, and a recording drum.

The first phase in the electroretinogram is a slow component which corresponds with the initial current passage through the optic nerve. The second phase is more rapid and corresponds with rod and cone function. The third phase, like the first, is slow, and corresponds to the terminal current passage through the optic nerve. On the chart the first phase rises, the second is variable, and the third declines. The patient should remain in a dark room for thirty minutes before the E.R. is made. The lids are anesthesized by the Van Lint method and kept open with a blepharostat. In 92 of the 102 patients examined an electroretinogram was obtained on the first trial. Interpretation was difficult in approximately 20. An illumination of 20 lux and a stimulation time of $\frac{1}{25}$ second were adopted. The electroretinograms were arbitrarily divided into four groups. In the first group all phases of the graph were diminished; among the conditions observed were retinal detachments, pigment degenerations, and glaucomas. In the second group, the negative phase dominated the graph. Circulatory disturbances were more frequent in this group. In the third group all three phases were absent because there was no retinal function. In the fourth group all phases were equally subnormal. In several cases, a parallelism existed between the changes of the electroretinogram and the evolution of the disease.

Chas. A. Bahn.

Palomar Palomar, A. Anticoagulant medication (heparin, dicumarol) in the treatment of thrombosis of the retinal veins. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, March, pp. 247-264.

Heparin was administered in four cases of thrombosis of the retinal veins; of which two involved the central vein and two one of its branches. Heparin was given intravenously in doses of 100 to 300 milligrams daily for 17 days. Dicumarol in doses of 100 to 200 milligrams was used orally, daily for 15 days, in eight cases of thrombosis of the central retinal veins and six in a branch. Improvement, only functional and not anatomic in some, was noted in all, especially where the medication was begun early. These drugs are contraindicated in hypertension, blood dyscrasias and icterus.

J. Wesley McKinney.

Plam, Erik. On the occurrence in the retina of conditions corresponding to the blood-brain barrier. *Acta Ophth.*, 1947, v. 25, pt. 1, pp. 29-35.

The findings in this laboratory study on seven rabbits confirmed the generally known incapacity of the retina to take vital staining with intravenously injected dyes, and its similarity to the central nervous system in that respect. The walls of the retinal vessels do not take the dye, which is in accord with the current opinion that the barrier to the passage of the dye in the central nervous system is formed by the vascular endothelium. The fact that the choroid which supplies nutrition to the outer layers of the retina, was found stained, whereas the retinal layers themselves did not take the stain, seems to indicate that the obstacle to the penetration of the dye in the retina must also be situated elsewhere than in the vascular wall. Louis Daily, Jr.

Wadensten, Lars. A case of bilateral non-attachment of the retina. *Acta Ophth.*, 1947, v. 25, pt. 1, pp. 61-71.

The patient, a seven-months-old in-

fant, one of premature biovum twins, was brought to the eye clinic with the history that she did not fix her gaze like her sister, and that the pupils shimmered gray. In each eye there was a white membrane with a suggestion of vessels pressed tightly against the posterior surface of the lens; the anterior chamber was shallow, and the iris and lens protruded. There was no pupillary reaction in the right eye, and it was enucleated. The detailed microscopic description shows a non-attachment of the retina, which was connected to the optic papilla by a cord of glial tissue. The literature contains about twenty reports of this congenital deformity, but only one case, that of Magnus, is analogous to the one here reported. The literature on the pathogenesis of this anomaly is reviewed. (3 photomicrographs.)

Louis Daily, Jr.

Walbeek, K. A case of degeneration of the macula lutea caused by central choroiditis. *Acta Ophth.*, 1947, v. 25, pt. 1, pp. 37-45.

A detailed clinical and histological description is given of an eye with a tumor-like mass in the macula which was enucleated because of hemorrhages and secondary glaucoma. The patient, a woman 40 years old, with a history of gall bladder disease, developed a central choroiditis in the left eye with vitreous opacities and involvement of the optic nerve. After five years she developed the tumor-like mass in the right eye, which was enucleated one year later. The histologic diagnosis was disciform macular degeneration. The literature on the etiology of this condition is reviewed, and it is argued that the history of a previous inflammatory process in the other eye supports the belief that the lesion is inflammatory, rather than vascular or degenerative in

origin. The site of the inflammatory process is in the choriocapillaris. (5 illustrations.)

Louis Daily, Jr.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Caminero, G. M. Investigations on the pathogenesis of quinine amblyopia. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, April, pp. 360-366.

Among the large number of malaria patients seen in North Africa in 1941 to 1943, Caminero found nine cases of quinine amblyopia. These patients were all seen early, and were all anemic people, with pale conjunctiva and dilated pupils. In addition to the usual symptoms, they had a diminished light sense, and delayed adaptation to light as well as darkness. They were followed for two years, and although they recovered their visual acuity, a constriction of the visual field remained. Caminero raises the question of a susceptibility to quinine amblyopia as a factor other than the toxicity of the drug itself. If such a factor exists, are there people sensitive to quinine, or does the malaria produce such a sensitization? Hemoglobinuric fever can be produced in malaria patients by the ingestion of very small quantities of quinine. Seeking to reveal the cause of this sensitization Caminero investigated the elimination of quinine in normal people and in malaria patients with and without quinine amblyopia. In normal individuals and in malaria patients quinine begins to be eliminated through the urine 25 minutes after ingestion, reaches the maximum after six hours, and is completely eliminated in three days. Of seven patients with quinine amblyopia the elimination was normal in three, somewhat delayed in two, and definitely delayed in two.

The total quantity of quinine eliminated was determined in only one case with amblyopia and found normal. Studies of kidney function failed to reveal any abnormalities. Ray K. Daily.

Kauntze, Ralph. Subacute bacterial endocarditis with onset as optic neuritis. *Brit. Heart. J.*, 1947, v. 9, Jan., pp. 34-37.

Two cases of subacute bacterial endocarditis are presented in the first of which there was retrobulbar neuritis at the onset and in the second bilateral papilloedema. Irwin E. Gaynon.

Leinfelder, P. J., and Robbie, W. A. Experimental studies in retrobulbar neuritis. *Amer. Jour. Ophth.*, 1947, v. 30, Sept., pp. 1135-1143. (8 tables, 16 references.)

Roussel, F., and Weekers, R. Changes of the critical flicker frequency in tobacco intoxication. *Ophthalmologica*, 1947, v. 113, April, pp. 215-223.

In a previous communication (*Ophthalmologica*, v. 112: 305, 1946) the authors described a method of measuring the critical flicker frequency of eccentric retinal areas and advocated the use of this method in the follow-up of diseases of the optic nerve. The paper under review deals specifically with cases of tobacco intoxication. The patients showed a lowering (slowing-down) of the critical flicker frequency in the region of the centrocecal scotoma, paralleling the latter in severity and extent. A slight lowering of the critical flicker frequency was found to persist after the visual field had returned to normal.

Peter C. Kronfeld.

Sanchez Mosquera, M. Ocular cysticercus. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, March, pp. 234-246.

(See Section 17, Systemic diseases and parasites.)

12

VISUAL TRACTS AND CENTERS

Beck, D. J. K. Upper parietal meningioma showing Foster-Kennedy syndrome. *Bristol Med. Chir. J.*, 1947, v. 64, Spring, pp. 11-12.

Whereas Kennedy stated that the syndrome associated with his name is a diagnostic criterion of the existence of an expanding lesion in the anterior fossa, this case illustrates the need to interpret the syndrome in the light of other signs and to pay attention to the stage at which the eye signs develop.

F. H. Haessler.

François, J. Binasal hemianopsia. *Ophthalmologica*, 1947, v. 113, June, pp. 321-343.

The author describes in detail two cases of neurinoma of the acoustic nerve and one case of opticochiasmatic arachnoiditis, all verified by operation and all showing chiefly binasal field defects. He compares the findings in his three cases with those in 49 similar surgically explored or pathologically examined cases from the literature. He also reviews the anatomy of the region of the chiasma. He concludes that the main mechanism concerned in the causation of binasal hemianopsia is a disturbance of the normal spatial relationship between the supero-temporal aspect of the optic nerves and the anterior cerebral arteries. The arteries may press against the nerves or the nerves may be crowded against the arteries. (11 figures.)

Peter C. Kronfeld.

Nichelatti, Paolo. Adie's syndrome in hysteric subject. *Boll. d'Ocul.*, 1946, v. 25, July-Sept., pp. 421-432.

A nun, 42 years of age, when in-

formed that her left pupil was larger than the right, complained of neuralgic pains of the left side of her face and photophobia, and her vision became reduced to 2/10 in each eye. Left pupillary reactions were as slow in normal daylight as in the dark. Her left pupil was enlarged when the patient was kept in a dark room for about an hour and became contracted when the patient was exposed to intense light for an hour. Consensual and accommodation reactions were also slow. The diagnosis was based on these changes of the left pupil, on the lack of deep reflexes, and the negative serologic examinations. The other ocular disturbances were hysteric in nature and disappeared under appropriate treatment. (Bibliography.) Melchior Lombardo.

13

EYEBALL AND ORBIT

Casanovas, José. **Orbital osteomas.** *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, April, pp. 335-347.

A review of the literature, and brief reports of six cases are presented. Two patients had growths in a sinus, two of the tumors arose from the orbital walls with a broad base, and two tumors were pedunculated. In one case osteoma was bilateral. In two patients the exophthalmos almost caused ocular dislocation. Five cases were dealt with surgically. Histologic examination showed that two of the tumors consisted of compact bone, and three were spongy. (8 illustrations.)

Ray K. Daily.

Shannon, C. E. G. **The exophthalmos of hyperthyroidism.** *Pennsylvania M.J.*, 1947, v. 50, August, pp. 1155-1159.

The author reviews briefly the current view of the relationship of exoph-

thalmos to hyperthyroidism and reports five illustrative case records.

F. H. Haessler.

14

EYELIDS AND LACRIMAL APPARATUS

Busacca, A. **A simple and easy method of blepharoplasty.** *Ann d'Ocul.*, 1947, v. 180, May, pp. 288-292.

Disinsertion of the external palpebral ligament facilitates marked displacement of the upper and lower lids. Greater advancement of the skin to cover traumatic or other colobomas is thus possible. Following local anesthesia and the administration of coagulin, venine, or other coagulating agents, external canthotomy to the orbital rim is performed. A subcutaneous vertical incision about one-fourth inch in the external palpebral ligament is made. The coloboma is freed of cicatricial tissue. A cutaneous incision is made roughly parallel to the upper or lower lid border and extending from the coloboma margin almost to the orbital rim. The skin is undermined to form a flap. The edges of the coloboma are approximated by a mattress suture horizontally placed, and the lid flap is drawn over the coloboma laterally and sutured. The canthotomy wound edges are approximated by laterally advancing, with a suture, the skin of the upper or lower lid approximately one-half inch. (11 figures.) Chas. A. Bahn.

Dollfus, M. A. **The irradiation treatment of the lid epitheliomas.** Report presented at the meeting of the Société d'Ophthalmologie de Paris, 1946, Nov., 160 pp.

The extensive research work on the irradiation treatment of lid epitheliomas carried on by the author and his collaborators at the Foundation Curie from 1927 to 1940 is reported.

The first part deals with the history, pathology and clinical manifestations of lid epithelioma, and the differential diagnosis from chronic ulcerative blepharitis, tuberculous and syphilitic lesions, and nevocarcinoma, is described.

The second part—the physical properties of radio-active substances in general, the characteristics of the different rays, and the occurrence and potential dangers of secondary radiation are discussed. The units of radium element and radium emanation, the Curie, are described in detail.

Other points of importance in the specification of every radium application are the shape and size of the carriers, their number, the kind and density of the primary and secondary filters, the positions and the distance between carriers and irradiated tissue, the strength of the carrier, the time of irradiation in hours, the energy as expressed in the units described, and the surface and depth extension of the irradiated tissue. A plastic material of beeswax 100 gm., paraffin 100 gm., and fine sawdust 25 mg. is molded on the face in varying thickness depending on the distance required for the irradiation. Radium needles in four different strengths and lengths, tubes, and gold seeds containing 1 to 2 millicuri radon are used for the contact treatment. A mixed irradiation treatment, namely surface irradiation plus curiepuncture, was used in infiltrating cancers.

The third part deals with X-ray treatment. The origin and peculiarities of X rays, the importance of the different filters, the irradiation with single large or divided small doses, and the results and dangers of this treatment are described in detail. The doses for circumscribed lesions vary from 2000 to 5000 r, most frequently 2600 to 3600 r. For extensive lesions 5000 r were given.

The maximal doses were 9600 r. The exact dosage is important because of the dangers of an insufficient treatment which not only might cause a radio resistance, but might also change the clinical form of the epithelioma to a more malignant type.

The contact-therapy of Chaoul, a comparatively new method in the irradiation of lid epithelioma is discussed. The principle of this method is the surface utilization of rays which penetrate but little and rapidly decrease in effect in the sub-epithelial layers. Their range is only two centimeters of surface diameter and one of depth range, which limits their general use but coincides with the average size of lid epithelioma.

Part four summarizes the pre-radiation care and immediate effects of the irradiation on the epithelioma. Part five contains the reports of the results and the failures of those treatments. The potential danger of ocular complication makes necessary a close collaboration of radiologists and ophthalmologists during every stage of the irradiation. The after care is especially important as patients with lid epithelioma have to continue in constant supervision for at least three years. Recurrences usually appear during this time.

In part six the author discusses the ocular complications and the means to avoid them. The improved methods, as well as the use of metal, especially lead shells in the form of a prothesis over the eyeball, have reduced the frequency of complications, but the latter can never be completely avoided. Early complications are mostly benign, late complications mostly insidious and of uncertain prognosis. Common complications are hyposecretion of the lacrimal glands, interstitial keratitis, corneal necrosis, iridocyclitis, secondary glaucoma, and opacities of the lens.

Young lenses are especially vulnerable. Degenerations of the retinal and choroideal vessels as sequelae of irradiations are rare.

In part seven the results of irradiation treatment are compared with the results of diathermy and surgical treatment. This comparison is not complete because of the lack of adequate reports concerning the late results of surgical treatment. A table shows the results of radium and X-ray treatment during the last 25 years. (379 references, 5 tables.)

Alice R. Deutsch.

Fine, M., and Waring, W. S. Mycotic obstruction of the nasolacrimal duct (*candida albicans*). *Arch. of Ophth.*, 1947, v. 38, July, pp. 39-42.

Numerous reports may be found in the literature of obstruction of the lacrimal passages produced by various fungi. *Streptothrix* and *leptothrix* are mentioned in most textbooks as the organism commonly encountered. Reports of mycotic obstruction of the nasolacrimal duct, however, are notably lacking. In this paper two cases of mycotic obstruction of the nasolacrimal duct are described, with identification of the yeast as *C. albicans* in one case. Recovery was spontaneous and immediate following extrusion of the castlike obstruction of the duct. (12 references.)

R. W. Danielson.

Godtfredsen, Erik. Relation between Sjögren's disease, the Plummer-Vinson syndrome, and ariboflavinosis. *Acta Ophth.*, 1947, v. 25, pt. 1, pp. 95-109.

The literature on the three syndromes is reviewed, and their interrelation analyzed in the hope of throwing some light on the etiology and pathogenesis of Sjögren's syndrome. In addition a report is made of an analysis of 23 cases of Sjögren's syndrome col-

lected since 1943 from the Ophthalmic Departments of the County Hospital, Gentofte, The Finsen Institute, and the State Hospital in Copenhagen. The patients were all women in the postmenopausal period. Twenty patients had chronic progressive polyarthritis. The articular affection had persisted from 1 to 30 years before the affliction was recognized as Sjögren's syndrome. The Plummer-Vinson syndrome, the most characteristic features of which are epithelial lesions in the upper alimentary tract and sideropenia, formed a part of the pathologic picture in three patients. All had greatly reduced or completely abolished lacrimal secretion, and most of them were treated for about five years with irritative instillations before the diagnosis of keratoconjunctivitis sicca was made. None had the superficial vascularization characteristic of ariboflavinosis. Treatment with viatmine B and iron relieved the alimentary tract symptoms in the three patients with Plummer-Vinson syndrome but in the others it was entirely ineffective. Sideropenia or riboflavin deficiency appear to have no etiologic significance in Sjögren's diseases, and in spite of the numerous common clinical features, it is concluded that Sjögren's disease differs essentially from ariboflavinosis and the Plummer-Vinson syndrome.

Louis Däily, Jr.

Redslob, E. Palpebral entropion from malformation of the Meibomian glands. *Ann. d'Ocul.*, 1947, v. 180, May, pp. 263-266.

An infant, seven months of age, was operated upon because of entropion and trichiasis. Under local anesthesia the tarsus was removed. Microscopically, a small circumscribed inflammatory zone and two malformed rows of Meibomian glands, traversed by new

formed blood vessels were observed. In the embryo the two lids are held together by an epithelial bridge at about the time the Meibomian glands are formed. The malformation apparently occurred at this time. Among the diagnostic conditions differentiated are fatty and amyloid degeneration, gumma, and obliterative endarteritis.

Chas A. Bahn.

Schuessler, W. W., and Filmer, G. A. A method for restoration of the cilia of the eyelids. *Plastic and Reconstructive Surg.*, 1947, v. 2, July, pp. 345-347.

The authors present a method of restoring the cilia to the eyelids with a vertical hair-bearing graft removed from the eyebrow. This is in contradistinction to the usual method which utilizes a horizontal section. For defects longer than the vertical dimension of the eyebrow, two sections can be removed.

The excellently reproduced photographs that accompany the one case report illustrate the more normal spacing and direction of the cilia which can be obtained.

Alston Callahan.

15

TUMORS

Casanovas, Jose. Orbital osteomas. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, April, pp. 335-347. (See Section 13, Eyeball and orbit.)

Höhr Castán, Jose. Ocular xeroderma pigmentosum. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, May, pp. 487-491.

A boy, 10 years of age, had a small whitish tumor mass, a xeroderma pigmentosum, on the lumbus of the left cornea for one and a half years. The patient also had several plaques of xeroderma pigmentosum in the cervical

and sternal zones. All other examinations were negative.

J. Wesley McKinney.

Huggert, A., and Hultquist, G. T. True glioma of the retina. *Ophthalmologica*, 1947, v. 113, April, pp. 193-202.

Only two cases of true retinal glioma consisting almost exclusively of adult glial cells have been reported, one by Dejean and one by McLean (*Arch. of Ophth.* 18:255). One new case is put on record in the paper under review. A male patient, age 77 years, presented himself at the eye clinic of the Caroline Hospital, Stockholm, with the complaint of gradual deterioration of the vision of the left eye for several years and pain and inflammation for the last two weeks. The eye was found to be in a state of absolute glaucoma. A yellowish mass, resembling a hypernephroma, filled the entire anterior chamber. During the enucleation the conjunctiva and Tenon's capsule were found to be indurated and difficult to detach. Hard yellowish masses occupied the inferior and nasal portions of the orbit. In places these masses had disintegrated into curd-like material. A tumor mass filled the interior of the globe almost completely; it had destroyed or replaced the retina and had invaded the optic nerve. The choroid was torn in several places but not thickened, the sclera appeared uninvolved.

Histologic examination showed that the tumor consisted chiefly of polymorphous cells with honeycombed, vacuolated cytoplasm. Silver impregnation revealed numerous argentophilic cells with a few short, scantily branched processes. In most places, the tumor was compact in structure with sparse bands of connective tissue between the cell masses. Pseudo-rosettes around blood vessels could be seen in moder-

ate numbers. The description is not clear with regard to the amount of necrosis, but its presence in the center of groups of tumor cells is mentioned. There was an abundance of mitotic figures and, as mentioned before, definite polymorphism of the nuclei. The authors classify the tumor as a true retinal glioma of the oligodendroglioma type. The extraocular masses are thought to be metastases. No statement is made about the postoperative course and termination of the disease.

Peter C. Kronfeld.

Hughes, L. W., and Ambrose, A. Massive melanosa of the eye. *Arch. of Ophth.*, 1947, v. 38, July, pp. 111-112.

This case is recorded not so much for its pathologic interest, because the tumor is one of the common ones affecting the eye, but because of its spectacular size. A photograph of this far advanced tumor is given. Paradoxically, two years after evisceration of the orbit the patient shows no recurrence.

R. W. Danielson.

Garcia Miranda A. Fibroma of the orbit. *Ophthalmologica*, 1947, v. 113, March, pp. 149-156.

A white male, 25 years of age, complained of slowly increasing protrusion of his left eye of about seven years' duration. Examination revealed a palpable hard tumor in the upper temporal portion of the left orbit. Roentgenologic findings were normal. The tumor was removed by the Kroenlein technique. It was well circumscribed and located outside the muscle cone. Its place of origin could not be ascertained. The histologic examination revealed a fibroblastic tumor consisting mainly of spindle-shaped cells in a criss-cross but

not truly fascicular arrangement. There was an abundance of heavy collagenous and of finer reticulin-like fibers. The author considers the tumor to be benign and of mesodermal origin, but is not entirely certain of his diagnosis because of the abundance of cellular elements. The main features of the tumor are shown in three good photomicrographs. There apparently was no opportunity for postoperative follow-up.

Peter C. Kronfeld.

Pfeiffer, R. L. Tumors of the eye and orbit. *N.Y. Acad. Med. Bull.*, 1947, v. 23, July, pp. 410-419.

The author describes the clinical manifestations of naevus, precancerous melanosis, malignant melanoma, retinoblastoma, lymphatoid disease involving the eye, granuloma, neurofibromatosis, cholesteatoma, and adrenal neuroblastoma.

Irwin E. Gaynon.

16

INJURIES

Adler, F. H., Fry, W. E., and Leopold, I. H. Pathologic study of ocular lesions due to lewisite (β -chlorovinyl-dichloroarsine). *Arch. of Ophth.*, 1947, v. 38, July, pp. 89-108.

The pathologic changes in the rabbit eye injured by lewisite are described. In the early stages changes appeared in the stroma which may be interpreted as a rapidly progressing necrosis of the whole stromal layer. This was seen in the loss of the nuclei of the corneal fibers, the loss of staining ability of these fibers and their loss of outline. These changes were first seen at the end of six hours and reached the maximum in 24 hours. The infiltration of the stroma began at the periphery at the 24-hour stage and was of poly-

morphonuclear cell type. This infiltrate was replaced by a round cell infiltrate at the end of the 10-day stage. Vascularization did not make its appearance until the end of five days. This vascularization involved all layers of the stroma but was most prominent in the middle layers. In 14 days the vascularization was fairly intense. In any eye treated with BAL there were no changes that could be attributed specifically to the treatment. The changes were similar to those observed in the untreated eye but were of milder degree. (15 figures.)

R. W. Danielson.

Atkinson, W. S. Exact surface localization of ophthalmoscopically visible foreign bodies in the vitreous chamber. *Arch. of Ophth.*, 1947, v. 38, July, p. 110.

Small foreign bodies in the vitreous chamber which are entangled in the retina and choroid or embedded in the sclera are often not pulled loose with the magnet unless it is applied close to or directly over the foreign body. In order to make the incision exactly at the point where the foreign body can be seen, a Walker retinal detachment pin is first inserted as a pilot as close to the area as possible. The incision is then adjusted according to the relative positions of the foreign body and the pin.

R. W. Danielson.

Marin Amat, M. A case of a foreign body imbedded in the external layers of the sclera. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, April, pp. 375-379.

Marin Amat reports an industrial injury, in a man 26 years old, whose right eye was perforated through the cornea by a foreign body, which was found by X-ray examination. Misleading yellow-

ish conglomerations were present in the lens, and on the retina. Attempts at extraction were unsuccessful, and the eyeball, greatly traumatized by these procedures, was finally enucleated. Histologic examination showed a fusiform, irregular, sharp piece of iron encysted in the outer layers of the sclera.

Ray K. Daily.

Rones, B., and Wilder, H. C. Nonperforating ocular injuries in soldiers. *Amer. Jour. Ophth.*, 1947, v. 30, Sept., pp. 1143-1160. (25 figures, 3 tables.)

Savin, L. H. The effect of aluminium and its alloys on the eye: a report presented to the vision committee of the medical research council. *Brit. Jour. Ophth.*, 1947, v. 31, Aug., pp. 449-502.

This comprehensive study is based on two clinical observations and extensive experimental work.

The author reviews the literature and presents two cases of intraocular aluminium foreign bodies. In each instance the fragment became coated and left multiple imprints due to shifting position before disintegrating into white powder after many months. Good vision was retained in one case.

For experimental study 34 intraocular implants were made. It was found that the ocular reaction was more severe with higher amounts, but there was no clinical difference between pure aluminium and various alloys. Both groups showed lens opacities, mild inflammatory changes in the iris, atrophy of the iris, retinitis proliferans and vascularization of various parts of the eye. Aluminium causes more destruction in the vitreous than in the anterior chamber. Early changes, chiefly vascular, occurred in tissues adjacent to the foreign bodies.

Fundus lesions showing widespread distribution of the aluminium in the tissues were present in nearly every case, no matter what the size or position of the implant. In six eyes there was apparently complete dissolution of the aluminium, but the author was unable regularly to obtain specific stains of the section to be sure of the true distribution in the ocular tissues.

Also noted in the experimental animals were bullous keratitis, staphylococci, zonular keratitis, interstitial and deep keratitis, pigmented cornea and folds in Descemet's membrane.

Aluminium had previously been regarded as comparatively inert in the eye. The author has conclusively shown that it causes widespread low-grade inflammatory and degenerative changes, seen histologically as well as clinically. Although aluminium and its alloys are not so destructive as iron and steel, these intraocular foreign bodies call for operative removal.

There is a graphic summary in which the findings in the eyes of the animals are made perspicuous by diagrammatic drawings. (21 figures of which 9 are in color.)

O. H. Ellis.

Sorsby, A., Haythorne, J., and Reed, H. Further experience with amniotic membrane grafts in caustic burns of the eye. *Brit. Jour. Ophth.*, 1947, v. 31, July, pp. 409-418.

This is a report of additional experience of the use of human amniotic membrane in chemical burns of the eye. In these severe burns, the eyes were generally found to be nearly white in 3 to 5 days after grafting and they were usually normal by the end of the week. Now 28 additional cases are reported, 21 of burns by lime, 5 by sodium hydroxide and 2 by fireworks. Corneas

were involved in all, and yet in only three eyes was the vision unsatisfactory. Terminal clarity of corneas was directly related to the interval between injury and treatment. The amniotic membrane is apparently tissue specific in its action. It does not lead to clarification of severe corneal damage but it does prevent corneal damage caused by a persistent raw conjunctiva. The details of preparing the amnion for grafting are described. Morris Kaplan.

Tanzariello, R. The tolerance of the eye to aluminum and its alloys. *Rassegna Ital. d'Ottal.*, 1947, v. 16, May-June, pp. 199-223.

Small pieces of aluminum and of various commercial compounds containing aluminum were introduced into the vitreous chamber of rabbits' eyes. The foreign bodies were retained from 10 to 187 days and the eyes were observed frequently with the ophthalmoscope. One of the compounds contained 90 percent of copper and this was as poorly tolerated as pure copper. Other compounds, with only 3.5 percent copper were much better tolerated. Pure aluminum caused practically no reaction. The author concludes that when intraocular foreign bodies of alloys of aluminum enter the eye, those which contain copper demand early efforts at removal, whereas pure aluminum may safely be followed for long periods. (74 references.) Eugene M. Blake.

17

SYSTEMIC DISEASES AND PARASITES

Casari, G. F. Ocular manifestations of erythema nodosa. *Rassegna Ital. d'Ottal.* 1947, v. 16, May-June, pp. 228-250.

The ocular manifestations of erythe-

ma nodosa are analogous to the lesions elsewhere. The picture is that of an allergic reaction, which may be homo-allergic, heteroallergic or para-allergic. The last named seems the most satisfactory explanation. Some cases are especially difficult to classify. The eye manifestations are particularly important because they may be isolated instances of the disease or may precede the manifestation in the skin and mucous membranes. Three cases are reported in which ocular lesions that had the appearance of phlyctenules complicated the general eruption. The literature is reviewed and a bibliography appended.

E. M. Blake.

Cordello, G. Ocular symptoms in subarachnoid hemorrhage. *Rassegna Ital. d'Ottal.*, 1947, v. 16, Jan.-Feb., pp. 50-63.

Subarachnoid hemorrhage may be a result of a general disease, such as infection, liver damage, blood disease or an intoxication. The source of the bleeding is either a ruptured aneurysm (frequently the result of congenitally defective structure of the vessel) or functional vasoneurotic disturbance, often endocrine in origin.

The ocular manifestations are disturbances of the motor nerves, changes in the optic nerves, particularly edema, retinal hemorrhages, and a group of symptoms, such as nystagmus, verbal blindness, violent retrobulbar pain, and loss of sight.

Three cases are reported in detail.

Eugene M. Blake.

Dekking, H. M. Tropical nutritional amblyopia ("camp eyes"). *Ophthalmologica*, 1947, v. 113, Feb., pp. 65-92.

"Nature, that most unscrupulous vivisectionist, has just finished one of her

greatest experiments, a war. Of all her vast laboratories, the South East Asia theater of war has yielded some very remarkable results from an ophthalmologic standpoint. Hundreds of thousands of men, women and children have been kept in cages for almost four years, and have been subjected to all kinds of deficient diets and to incredible physical and mental strains." Under these circumstances, which the author has well described and hardly exaggerated, a tropical nutritional amblyopia (called "camp eyes" by the Dutch physicians) has occurred on a much more extensive scale than ever before. Striking features of the disease are its occurrence in the concentration camps of South East Asia and not of Germany and its predilection for adult males of light complexion. Among women the disease is so rare that "in many women's camps not even the name (of the disease) was known." The onset is usually gradual, with bilateral irregular paracentral scotomas, nyctalopia and a tingling or burning sensation in the feet and legs. The author has not seen the earliest stages, but other physicians have reported congestion of the retinal vessels and small retinal hemorrhages in some of the patients (percentage not known). In the late stages the maculae may be slightly abnormal and the temporal halves of the discs are pale. The prognosis is bad. Adequate food plus supportive measures continued for periods of eight months and longer have not brought about any improvement.

While in the concentration camps the patients' food consisted of red or white rice and a very diluted vegetable soup. Thus, there existed a deficiency of all vitamins as well as of animal proteins and of fat. The author discusses all likely causes of the amblyopia and ar-

rives at the conclusion that the disease "cannot be ascribed to one single agent, but that it is most probably due to gross deficiency of B vitamins, plus an intoxication (tobacco?), plus, perhaps the intense tropical sunlight as an aggravating factor." Peter C. Kronfeld.

Grant, W. T. Complete removal of craniopharyngioma with recovery from blindness. *Bull. Los Angeles Neurol. Soc.*, 1947, v. 12, March, pp. 53-58.

A two-year-old Mexican boy had complete blindness for three weeks which began 12 days after a head injury. The optic discs were normal. The left pupil responded to light two days after the extirpation of a craniopharyngioma and the child was able to see on the seventh day. Irwin E. Gaynon.

Rugg-Gunn, A. A case of recurrent aphthous uveitis with associated ulcer vulvae actum. (Lipschütz). *Brit. Jour. Ophth.*, 1947, v. 31, July, pp. 396-409.

Aphthous uveitis is a new and rather rare clinical entity which presents three main groups of symptoms. These are a periodically recurring uveitis, skin eruptions which consist of macular pustules that resemble those of secondary lues and recurrent erythema nodosum, and aphthous ulcers in the mouth and genitals. The eye-symptoms appear late, though once established, progress rapidly toward deterioration and blindness. The etiology is unknown and it is particularly characterized by its resistance to any known treatment.

The author reports his observations of a woman, 22 years of age, who had recurrent uveitis, in alternating eyes, for over a year before other signs developed. Although she was resistant to several regimens of therapy she reacted best to intravenous protein. During the

year it was felt that the infection was tuberculous. Buccal aphthae then appeared, followed by a severe aphthous ulcer of the vulva. The left eye progressed to blindness whereas the aphthous lesions apparently healed spontaneously during the latter months of a normal pregnancy. The skin lesions did not appear at all. The author insists that all signs point to a virus as the causative agent. (5 diagrams.)

Morris Kaplan.

Sanchez Mosquera, M. Ocular cysticercus. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, March, pp. 234-246.

A man, 40 years of age, had noted defective vision in his right eye for three weeks. There was a gray haze, aching, and a burning sensation of the eye. Ophthalmoscopic examination showed a brilliant gray-blue perfectly spherical cyst in the optic nerve head which contained a tapeworm scolex complete with hooks and four suction discs. The cysticercus moved about constantly. *Tenia saginata* was also found in the feces. The cysticercus was removed after some attempts to kill it by means of radium applications and sulfanilamides. (Photographs.)

J. Wesley McKinney.

Schmidt, A. E., and von Albertini, A. The ocular vessels in endangiitis obliterans (von Winiwarter-Buerger). *Ophthalmologica*, 1947, v. 113, March, pp. 129-148.

Marchesani was the first ophthalmologist (1932) who considered endangiitis obliterans as the cause of vascular ocular diseases such as retinal periphlebitis, recurrent vitreous hemorrhages with the associated uveitis, retinal vascular spasms, embolisms, and thromboses. Marchesani's view did not

become generally accepted. A. E. Schmid, one of the authors of the paper under review, in a previous publication (*Ophthalmologica*, 110:259, 1945) denied any relationship between endangiitis obliterans and retinal periphlebitis. The present study deals with the part played by Buerger's disease in spastic and occlusive diseases of the retinal vessels.

The pathology of the endangiitis process is described and illustrated. The earliest change is a transient fibrinous inflammation of the intima, followed by a chronic stage in which the arterial or arteriolar wall undergoes sickle-shaped thickening due to deposition of "fibrinoid" masses which gradually increase in thickness through additional fibrinoid deposition but also through organization and, later on, lipoid infiltration. The latter, however, is always a secondary process in contradistinction to the primary degenerative arteriosclerosis which is not a lumen-reducing disease. The preferred sites of endangiitis obliterans are the vessels of the lower extremities, the coronary arteries, the aorta and the cerebral arteries. The angiitic disease may cause secondary arterial occlusion distal to the specific lesion or secondary ("additional") thrombosis next to it; it may also be responsible for spastic aggravation of the existing vascular disease.

The findings in a number of cases studied pathologically by the authors supported by a critical survey of the literature leads them to the conclusion that ocular involvement is very rare in endangiitis obliterans. If ocular involvement does occur, it is secondary to localization of the disease in the carotid artery or its branches. In most of these cases the ocular involvement has been in the form of conjugate deviation,

hemianopic scotomas, transient visual disturbances, transient diplopia, cortical blindness or papilledema. True intraocular vascular disturbances, such as arterial spasm, embolism or thromboses, have been extremely rare. In all these eye manifestations the primary site of the disease is in the carotid or its branches. Retinal hemorrhages may occur, but can always be distinguished from those of retinal periphlebitis which, the authors maintain, is unrelated to endangiitis obliterans.

Peter C. Kronfeld.

Shannon, C. E. G. The exophthalmos of hyperthyroidism. *Pennsylvania M.J.* 1947, v. 50, August, pp. 1155-1160.

The author reviews briefly the current view on the relationship of exophthalmos to hyperthyroidism and reports five illustrative case records.

F. H. Haessler.

Simonelli, Mario. Focal infection in ophthalmology. *Riv. di Oftalm.*, 1946, v. 1, Nov.-Dec., pp. 706-739.

The author reviews almost 200 papers and adds two observations. One patient had serofibrinous metastatic iridocyclitis after infection from a subcutaneous foreign body, the other an optic neuritis believed to be secondary to a periapical abscess. The latter recurred after eleven years.

K. W. Ascher.

Zewi, M. Reiter's disease. *Acta Ophth.*, 1947, pt. 1, pp. 47-60. (See Section 5, conjunctiva.)

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- HYGIENE, SOCIOLOGY, EDUCATION AND HISTORY

Duke-Elder, Stewart. *Ophthalmology during the war and in the future.*

Amer. Jour. Ophth., 1947, v. 30, Sept., pp. 1073-1080.

Grant, W. M. Students' model for slit lamp biomicroscopy of the aqueous humor. Arch. of Ophth., 1947, v. 38, July, p. 109.

For familiarizing students with the biomicroscopic appearance of the normal and the abnormal aqueous humor a series of model eyes is of considerable value. The type of model which the author has found satisfactory in post-graduate teaching has a convex glass "cornea," a rubber "iris" and a glass "lens," with an "anterior chamber" which can be filled with various artificial "aqueous humors." The construction is described.

The following aqueous preparations have been found satisfactory. Distilled water simulates normal aqueous in that it gives the appearance of an "optically empty" anterior chamber. Diluted plasma with protein concentrations of 0.2 and 2 percent presents different intensities of the Tyndall effect. A dilute suspension of red blood cells in isotonic solution of sodium chloride, a suspension of cholesterol crystals, and a suspension of diatomaceous earth show the thermal convection currents.

R. W. Danielson.

Samuels, Bernard. New York as an ophthalmological center. Amer. Jour. Ophth., 1947, v. 30, Sept., pp. 1081-1093. (16 figures.)

NEWS ITEMS

Edited by Donald J. Lyle, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. Howell Llewellyn Begle, Detroit, Michigan, died June 5, 1947, aged 70 years.

Dr. Andrew Johnson Browning, Portland, Oregon, died May 20, 1947, aged 66 years.

Dr. Louis Richard Haas, Pittsburg, Kansas, died June 30, 1947, aged 44 years.

MISCELLANEOUS

GIVES OPHTHALMIC BOOKS

Dr. Frederick W. Adams, formerly of Seattle, Washington, and now of Carmel, California, has presented his collection of books on ophthalmology to the new medical school of the University of Washington. The bound volumes number 215, and there are many unbound journals. Since his retirement, Dr. Adams has been a frequent exhibitor in the Physicians Art Association.

RARE GLASGOW JOURNAL FOR SALE

A copy of the *Glasgow Medical Journal*, dated 1829, bound in cloth and leather, is available for purchase. This is an historical item of great rarity and of great interest to ophthalmologists because it contains three classical articles by the pioneer eye surgeon, William Mackenzie, one time lecturer on the eye in Glasgow University. The price has been set at \$50.00. Anyone interested may communicate with the Ophthalmic Publishing Company, 700 North Michigan Avenue, Chicago 11, Illinois.

BETTER VISION INSTITUTE MEETS

The Better Vision Institute held its third quarterly meeting in New York City on October 3rd. M. J. Julian, president of the Institute, gave a visual presentation and detailed descriptions of recent, current, and future projects.

Of immediate interest to professional members was the new series of 24 scientific leaflets just off the press. These leaflets are rich in information on practically all aspects of vision. For example, the leaflet entitled *Eyes on the Jump* deals with the process of reading and the value of professional guidance in improving reading habits. *Fit for Your Eyes* highlights the important duties of the ophthalmic dispenser and explains how his precise art can supply each individual with the glasses which will most help his appearance as well as his vision. *Learning to See* discusses the development of "seeing gaits" in people, and how good or bad ones may be acquired just as different walking gaits are ac-

quired. *Thank you B. F.* is the scientific story of Franklin's contribution to human progress in the invention of bifocal lenses.

Other subjects covered in these leaflets range from the new telescope on Mount Palomar to heredity as it applies to eyes. But all topics are treated in a scientific manner, and the need for regular professional eye-care is consistently emphasized. The series of leaflets will be distributed to Institute members, and through them to schools, museums, and other educational centers.

Mr. Julian gave an outline presentation of the new set of educational charts which are being developed. These will comprise pictorial lessons on the human eye and how it sees, light and its relation to vision, color and color perception, lenses and how they bend light, faults of seeing, eye tests, and seeing skills. The charts will conclude with an "Eye-Q" quiz on a wide variety of visual themes.

Plans were also sketched for the Institute's general educational work during 1948. The meeting's guest speaker was Dr. Jules Backman, associate professor of economics at New York University.

NEW BROCHURE READY

The Bausch & Lomb Industrial Vision Department announces that a new brochure for the ophthalmic profession is now available. Entitled *Ortho-Rater Scores and Clinical Examinations*, the booklet, Bulletin A-608, is designed to fill a need for correlating the Ortho-Rater scores with the clinical approach.

This timely brochure, produced in answer to professional requests for an explanation of the Ortho-Rater-clinical relationship, was held until comprehensive studies on the subject had been developed.

Requests for Bulletin A-608 may be made by letter or post card to the Industrial Vision Department, Bausch & Lomb Optical Co., Rochester, New York.

SOCIETIES

READING HAS 69TH MEETING

The 69th meeting of the Reading Eye, Ear, Nose, and Throat Society was addressed by Dr. Gabriel Farrell, director of Perkins Institute and Massachusetts School for the Blind, Watertown, Massachusetts. The subject of his talk was "Modern Trends in Education of the Blind."

BROOKLYN MEETING

The Brooklyn Ophthalmological Society held its 101st regular meeting on October 23rd. The scientific program included a paper by Dr. Algernon B. Reese on "Discussion of Some Controversial Aspects of Ocular Tumors," and one by Dr. Alson E. Braley on "Virus Diseases of the Cornea." Dr. Mortimer A. Lasky presented a case report on "Progressive Essential Atrophy of the Iris." Dr. Leonard Posner was elected to membership.

MILWAUKEE SOCIETY PROGRAM

Dr. John G. Bellows, Chicago, was a guest speaker at the October 28th meeting of the Milwaukee Oto-Ophthalmic Society. His subject was "Use of Antibiotics in Ophthalmology: With Special Reference to Streptomycin." Dr. Emil Rothstein spoke on "Streptomycin in Otolaryngology."

NEW SOCIETY ORGANIZED

The newly organized Los Angeles Ophthalmological Society has elected the following officers: Dr. Orwyn Ellis, chairman, and Dr. John A. Bullis, secretary. The society meets at 6:30 p.m. on the third Tuesday of each month from September through June. The meeting place is at 3550 Wilshire Boulevard.

ANNOUNCEMENTS

RESERVATIONS FOR HAVANA MEETING

All those who are planning to attend the III Pan-American Congress of Ophthalmology in Havana, Cuba, January 4 to 10, 1948, *and have not already done so*, should send their inscription fee of ten dollars together with a deposit for a room (ten dollars) to Dr. Miguel A. Branly, Edificio Bacardi 70, Piso, Havana, Cuba, at the earliest possible moment. Those who have confirmed reservations in the hotels will have no need to fear that their reservations will be cancelled.

SCHOENBERG MEMORIAL LECTURE

The first annual Mark J. Schoenberg Memorial Lecture will be held at the New York Academy of Medicine at 8 p.m., December 1st, under the joint sponsorship of the New York Society for Clinical Ophthalmology and the National Society for the Prevention of Blindness. The speaker of the evening will be Dr. Peter C. Kronfeld, of Chicago, head of the Illinois Eye and Ear Infirmary, whose subject will be "The Canal of Schlemm."

This lectureship was established as a memorial to Dr. Schoenberg's interest and original work in the control of glaucoma.

PERSONALS

GOOD-WILL LECTURE, TOUR

Dr. Daniel B. Kirby, New York, returned recently from a good-will lecture and conference tour of South America. Under the auspices of the Pan-American Association of Ophthalmology, Dr. Kirby visited Rio de Janeiro and São Paulo, Brazil; Montevideo, Uruguay; Buenos Aires, Rosario, and Cordoba, Argentina; Santiago, Chile; and Lima, Peru. Dr. Kirby reports that the South American oculists are very cordial and that many of them plan to attend the III Pan-American Congress in Havana and to visit the United States either before or after the Congress.

ADDRESSES OKLAHOMA MEETING

Dr. C. Wilbur Rucker of the Mayo Clinic, Rochester, Minnesota, was a guest speaker at the 17th annual meeting of the Oklahoma City Clinical Society, October 27th to 30th.

GUEST SPEAKER AT UTAH

Dr. A. Ray Irvine of Los Angeles spoke at the 52nd meeting of the Utah State Medical Association at Salt Lake City.



FIG. 2. (GOTS, THYGESON, AND WAISMAN.) SEBORRHEIC BLEPHARITIS OF SEVERAL YEARS' DURATION WITH TYPICAL COARSE GREASY SCALES. THIS SUBJECT ALSO HAD SEBORRHEIC DERMATITIS OF THE BROWS, SCALP, AND RETROAURICULAR FOLDS.

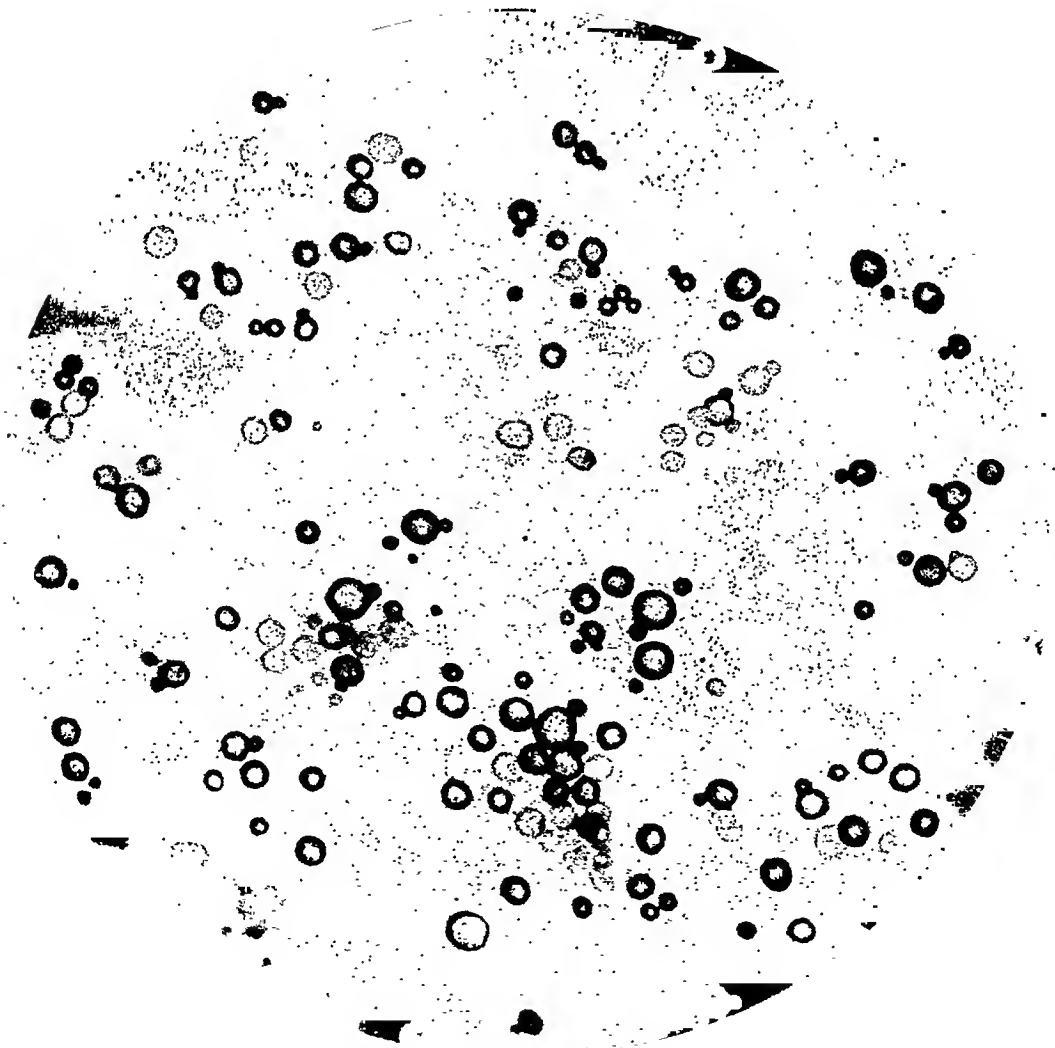


FIG. 3. (GOTS, THYGESON, AND WAISMAN.) LID-MARGIN SCRAPINGS FROM A CASE OF SEBORRHEIC BLEPHARITIS WITH ASSOCIATED SEVERE CONJUNCTIVITIS AND KERATITIS. GIEMSA STAIN. DRAWN FROM A MAGNIFICATION OF $\times 900$.

OBSERVATIONS ON *PITYROSPORUM OVALE* IN SEBORRHEIC BLEPHARITIS AND CONJUNCTIVITIS*JOSEPH S. GOTS, M.S.†
*Philadelphia, Pennsylvania*PHILLIPS THYGESON, M.D.‡
San Jose, California

AND

MORRIS WAISMAN, M.D.
Tampa, Florida

INTRODUCTION

Pityrosporum ovale, a yeastlike fungus as yet unclassified, was first described in 1874 by Malassez¹ who considered it to be the cause of seborrheic dermatitis. Although *P. ovale* is constantly present in this disease, there is still a difference of opinion among dermatologists as to whether its role is pathogenic or purely saprophytic. Etiologic studies have been handicapped by the fact that pure cultures of *P. ovale* have been obtained only with great difficulty, and by the fact that no experimental animal has been shown to be truly susceptible to seborrheic dermatitis. A number of inoculation experiments on human beings have been reported but the results have always been in doubt because of the possibility of error in the identification of the organism and in the interpretation of the induced skin lesions.

* Presented at the 16th scientific meeting of the Association for Research in Ophthalmology, Inc., Atlantic City, June, 1947. This study was made possible by a grant from the Berthold Guggenheimer Donation.

† From the Department of Bacteriology, University of Pennsylvania Medical School.

‡ From the Division of Ophthalmology, University of California Medical School, San Francisco.

Seborrheic dermatitis, whose major localization is the scalp (seborrhea capitis, pityriasis capitis), has long been known to affect the eyebrows and eyelids, seborrheic blepharitis being one of the principal types of lid-margin infection. In 1938, Kile and Engman² reported finding varying numbers of *P. ovale* in scrapings from the lid margins of 21 of a series of 24 patients with blepharitis. In many instances large numbers of the organism were seen, even in the presence of secondary pyogenic infection. Nearly every one of these patients also had pityriasis of the scalp. As a result of numerous attempts to cultivate *P. ovale* from the lid margins of each of 10 of these patients, cultivation was obtained in three. Scales from the eyelids of six patients were used to inoculate excoriations on the chest. In two instances there were positive reactions consisting of scaliness, slight erythema, and a subsequent browning of the skin. The lid margins of five rabbits were rubbed with *P. ovale* culture without result.

In 1945, one of us (P. T.)³ reported finding *P. ovale* in a high percentage of scrapings from cases of blepharitis and noted the close correlation between the

clinical manifestations of seborrheic blepharitis and the demonstration of the organism. He suggested that lid-margin scrapings were of value in the diagnosis of seborrheic blepharitis and of even greater value, as a guide to therapy, in evaluating the importance of the seborrheic factor in cases showing pyogenic infection.

The present study was undertaken in an attempt to cast further light on the role of *P. ovale* in seborrheic blepharitis and in the conjunctivitis and keratitis which sometimes accompany it. It is concerned with the morphology of the organism, its cultivation, its frequency in external inflammations of the eye, and its pathogenicity for man and animals.

ISOLATION OF *P. OVALE*

All reports in the literature indicate that *P. ovale* is extremely difficult to cultivate. Since it does not have absolutely distinctive morphologic characteristics and fails to produce specific lesions on animal inoculation, it has been difficult to prove that fungi isolated from the scales of seborrheic dermatitis were indeed *P. ovale*. Benham⁴ has recently reported the cultivation of the organism and has defined its cultural characteristics. From her work it would seem that identification of the organism in culture is based essentially on its microscopic morphology, on its colony appearance and rate of growth, and, most importantly, on its lipophilic properties.

METHOD

In the studies reported here, the following media were employed: (1) Sabaraud's dextrose agar (Difco), (2) wort agar (Difco), and (3) wort agar plus 1.5-percent oleic acid. The dehydrated wort agar was used in a concentration of 6 percent instead of the 5 percent recommended by the manufacturer, because the latter produced too soft a

medium after the addition of oleic acid.

Cultures from blepharitis subjects were made by removing the macroscopic scales from the lids with a sterile platinum wire or spatula and introducing them directly to the surface of the agar plate. After the scales had been removed, the lids were rubbed with a sterile cotton swab which was then streaked onto the unused portion of the agar plate. In the cases in which no scales were evident, the swab method only was employed. Plates were sealed with wide rubber bands, incubated at 37°C., and examined daily for growth. As soon as any colony growth whatever appeared which resembled *P. ovale* microscopically, the colony was streaked out on the plate with a wire loop. A more luxuriant growth was thus obtained in a shorter time than would otherwise have been possible.

Cultures of dandruff were made by having the patient brush his hair with his fingers over an exposed plate. The plates were incubated at 37°C. and when growth first appeared on the scales, or around them, it was streaked out.

From cases of seborrheic dermatitis, scales were obtained with a platinum loop or spatula and implanted directly onto the surface of the culture plate.

Isolation from blepharitis. A total of 24 cases of blepharitis showing yeastlike bodies suggesting *P. ovale* in lid-margin scrapings were studied for the presence of *P. ovale*. On Sabaraud's medium, which was used in 16 of the 24 cases, staphylococci were recovered invariably and in several instances there were also other cocci and Gram-positive rods. On this medium, staphylococci, although not abundant, were by no means inhibited. A yeast which was not *P. ovale* was isolated from one case. Contaminating molds were not uncommon.

On wort agar, which was used in all 24 cases, Gram-positive cocci were found

in a few cases and yeasts in four. No *P. ovale* were isolated. Contaminating molds, particularly *Penicillium*, *Aspergillus*, and *Alternaria*, were common.

Wort agar containing 1.5-percent oleic acid was also used in all 24 cases. No bacteria grew on this medium, but yeasts were isolated from six cases. Molds were uncommon although their rapid overgrowth in three cases necessitated the discarding of plates. Organisms believed to be *P. ovale* were isolated from five cases, that is, 5 out of 24, or 21 percent. Three of these isolations were subcultured and maintained through several generations. The other two were never successfully isolated in pure culture and were lost due to contaminating molds. The first colonies of the organism appeared in from 4 to 7 days.

In a subsequent culture study made in San Francisco, *P. ovale* was isolated in pure culture on wort agar containing oleic acid from 1 of 5 cases of seborrheic blepharitis from which isolation was attempted and has been maintained in pure culture through 10 transfers.

Isolation from dandruff (pityriasis capitis). Six cases of dandruff, in which *P. ovale*-like organisms were readily demonstrable by microscopic examination of the scales, were cultured on wort agar containing oleic acid. Isolation of the organism was accomplished in 4 of the 6 cases.

Isolation from seborrheic dermatitis. *P. ovale*-like organisms were found in the epidermal scales of three patients with seborrheic dermatitis of the face. The scales were removed and planted on wort agar containing oleic acid. Typical *P. ovale* were isolated from all three cases.

PROPERTIES OF *P. OVALE*

The following criteria were used for the identification of the organism in this study: (1) Microscopic morphology,

which included typical bottle forms as described in the literature. (2) Colony morphology; that is, the slow-growing colonies of typical appearance and color as described by Benham.⁴ (3) Lipophilic properties as determined by (a) failure to grow either in primary isolation or in subculture in media not containing oleic acid but readiness to grow in media containing it, and (b) growth characteristics in Benham's synthetic medium.⁵ This is a clear aqueous solution of inorganic salts and glucose to which oleic acid is added. The lipophilic organisms produce an opacity of the oil globules, by growing in and around them, and leave the aqueous portion clear. Nonlipophilic organisms produce a marked turbidity in the aqueous portion and the oil globules remain clear and translucent. (4) Confirmation of the isolation (3 cases) by Dr. Rhoda Benham of Columbia University.

The cultural characteristics of the organisms isolated in this series coincided with those described by other workers, including Benham⁴ and Moore and associates.⁶ The bottle or flask-shaped forms were typical and characteristic. While these forms predominated in cultures, other forms were also found, including dumb-bell shaped, elongated, oval, lemon-shaped, pear-shaped, and budding forms. The size of the oval and elongated forms varied from 2 to 7 microns in length and from 1½ to 2½ microns in width. The organisms had a definite tendency to form clumps.

The first colonies appeared in from 4 to 7 days after inoculation but subcultures grew more rapidly, colonies appearing in from 2 to 5 days. A cheesy odor was characteristic. Typical colonies were small (½ mm. in diameter), convex, granular, feather-edged, and light tan in color. The color darkened with age and the oily surface characteristic of young colonies became dry and powdery. Aging also pro-

duced corrugation and wrinkling of the colony which became hard, brittle, compact, and impossible to emulsify. On subculture, giant colonies as large as 12 mm. in diameter developed after two weeks' growth. Some strains became nonviable after multiple subcultures but three strains survived 15 subcultures. These three were sent to New York to Dr. Rhoda Benham who reported that they were identical with the strains of *P. ovale* isolated by her.

P. OVALE IN LID-MARGIN SCRAPINGS

Figure 1 illustrates the usual appearance of the organism in lid-margin scrapings. There was considerable variation in morphology, but spherical cells, both large and small, and often with budding, were the most common forms. Flask or

bottle forms, so common on the scalp, were rarely seen in preparations from the lid margin. The smallest cell observed was about 2 microns in diameter and the largest about 11 microns. It was noted on repeated examination that in the same individual there would be a preponderance of spherical budding forms on the lid margins and a preponderance of oval and flask-shaped forms on the scalp. In a certain number of cases, however, almost 100 percent of the forms on the lid margins were flask-shaped. No clear relationship between the type of clinical blepharitis and the preponderance of either spherical or oval forms was apparent. Moore and his associates,⁶ on the other hand, stated that small, ovoid, budding forms were characteristic of acute, rapidly spreading infections, that both ovoid and spherical cells were seen in active

subacute infections, and that in chronic or quiescent lesions many large, thick-walled, resting cells, as well as both ovoid and spherical cells, were to be found.

In this study budding yeast forms morphologically like *P. ovale* were found in 100 percent of 143 cases of clinically typical seborrheic blepharitis. As previously reported by one of us, typical seborrheic blepharitis (fig. 2) is squamous in type, with large, greasy scales, and is associated with seborrheic dermatitis of the scalp and often of the brows. While this is the more common form, the disease may also appear as a squamous blepharitis with dry, small scales and hyperemic lid margins. Excluded from this study were a considerable number



Fig. 1 (Gots, Thygeson, and Waisman). *Pityrosporum ovale* in lid-margin scrapings from a case of typical seborrheic blepharitis. Giemsa stain. (Magnification $\times 2,400$.)

of cases complicated by pathogenic staphylococci.

The organisms were most numerous in scrapings from those portions of the lid margins which showed the greatest inflammation and, as also reported by Moore and associates,⁶ they were almost always present in the upper portion of the hair follicles of the cilia. They could be seen adhering to the shafts of cilia removed and examined microscopically.

The effect of therapy upon the organism in lid-margin scrapings was significant. The customary treatment for seborrheic blepharitis has been twice-weekly applications of silver nitrate to the lid margins and twice-daily applications of an ointment consisting of 1-percent ammoniated mercury and 1-percent salicylic acid in petrolatum. Under this treatment there was rapid disappearance of the organisms from scrapings, but if treatment was interrupted prematurely for any length of time, the organisms inevitably recurred. Moreover, when apparently healed cases suffered recurrences, *P. ovale* invariably reappeared in lid margin scrapings.

Treatment with 5-percent sulfathiazole ointment or penicillin ointment alone did not significantly affect the number of *P. ovale* in scrapings. This paralleled the lack of therapeutic effect of these two preparations on pure seborrheic blepharitis.

SENSITIZATION TO *P. OVALE* EXTRACT

An extract of *P. ovale* culture, prepared according to the method employed in the preparation of trichophyton,⁷ was used for sensitivity studies in 46 individuals suffering from seborrheic blepharitis in which *P. ovale* was demonstrated in scrapings. All cases also had scalp infection of one degree of severity or another. The test was made by the injection

of 0.1 cc. of the extract intradermally into the skin of the forearm or upper arm. Readings were made in one hour and again in 24 and 48 hours. No immediate reactions of significance were noted and only 5 of the 46 individuals showed delayed reactions believed to be significant. In these there was a tuberculinlike reaction and in two of the cases the area of erythema was six inches or more in diameter. Of these five positive cases, three had severe seborrheic blepharitis with severe conjunctivitis and keratitis. These were the only severe cases in the entire group of 46 individuals tested for skin sensitivity.

Sixteen individuals without seborrheic blepharitis, and without obvious scalp infection or history of seborrheic dermatitis, were also tested. In these there were no significant reactions, immediate or delayed.

ANIMAL AND HUMAN EXPERIMENTATION

ANIMAL SUBJECTS

Transmission experiments with scrapings from seborrheic blepharitis. A search of the literature disclosed no record of the production of a typical seborrheic dermatitis or blepharitis in animals with scrapings from the human disease, and no record of the occurrence of the disease spontaneously in animals. In a rather wide experience with laboratory animals, including monkeys, apes, dogs, guinea pigs, rabbits, rats, and mice, we do not recall ever having seen any skin lesion suggestive of seborrheic dermatitis or blepharitis. It seemed worthwhile, however, to attempt transmission of the disease with scrapings from seborrheic blepharitis. For this purpose 12 cases were chosen in which *P. ovale* was present in large numbers in the epithelial scrapings. Inoculation by light scarifica-

tion with a platinum spatula was made directly from the lesions. The skin, lid margins, and conjunctivas were inoculated simultaneously in a total of 18 rabbits and 21 guinea pigs. In no instance did an infection resembling seborrheic dermatitis result. A mild, self-limited, scaly dermatitis of short duration developed in five rabbits but could not be considered significant. Except for transient hyperemia of the conjunctiva after inoculation, no conjunctival changes were noted in either rabbits or guinea pigs.

Transmission experiments with P. ovale culture. Skin. Two rabbits were inoculated by rubbing *P. ovale* organisms, obtained from heavy agar-plate growth, into a scarified area on one side of each rabbit. As a control the other side was inoculated similarly with a nonpathogenic yeast (*Saccharomyces*).

RABBIT 1. There was nothing of note until the sixth day when a definite scalliness appeared on the side inoculated with *P. ovale*. The control side also tended toward scalliness but the scales were firm and intact in contrast to the loose, flaky scales on the side inoculated with *P. ovale*. Methylene-blue mounts of these scales were negative and no organisms were obtained from them in culture. Examinations were made periodically. The scalliness persisted and on the 14th day, scales which were cultured yielded an organism which was at first thought to be *P. ovale*. The similarity was striking but further studies showed that it was not *P. ovale* as it grew readily in the absence of fats and developed mycelia. The scaly condition disappeared spontaneously and on the 24th day the rabbit appeared to be normal.

RABBIT 2. There was nothing of note until the sixth day when a thick, brownish yellow encrustation developed at the site

of the *P. ovale* inoculation. The appearance of this lesion corresponded with the description of the lesions on rabbits given by Moore and associates.⁶ The control site presented a few fine, thin crusts which were not as heavy nor as thick as those on the inoculated side and may well have been due to the scabbing over induced by the scarification. The crusts from the side inoculated with *P. ovale* were removed and *P. ovale* forms were found in methylene-blue mounts and were grown successfully in culture. In this experiment there was no doubt as to the organism's identity. The crustlike appearance rapidly disappeared and on the 10th day was replaced by a flaky, loose scalliness. No organisms were demonstrated in these scales nor isolated in culture. By the 19th day the area appeared normal. No spreading occurred.

In an effort to determine the effect of scarification alone, the skin was scarified as before but no organisms were introduced. A slight scalliness with a few fine crusts appeared. This lesion was comparable to that produced by the control inoculation of Rabbit 2. No loose, flaky scalliness developed.

Thirty days after the inoculation of Rabbit 2, identical inoculations were made at the same sites. The reactions were the same as in the first experiments and *P. ovale* forms were found in the scales. There was no evidence of sensitivity to the previous inoculation. No positive cultures were obtained, but in this connection it should be borne in mind that the culturing of the rabbit scales was extremely difficult due to the profusion of contaminating molds; the one positive culture obtained in the first experiment was barely saved. Before the second inoculations were made the skin of one of the areas was rubbed with oleic acid. This was done to see if the "take" would be

better. The oleic acid had no apparent effect on the type or degree of response.

Eye. The upper lid of the eye of a rabbit was rubbed with growth from a culture of *P. ovale*. A control yeast was rubbed on the lid of the other eye. No changes occurred until the ninth day when a macroscopic scaliness appeared along the margin of the lid inoculated with *P. ovale*. Scrapings from this lesion showed many *P. ovale* forms and identical forms were demonstrated continuously in scrapings taken on the 11th, 19th, and 21st days. No organisms were found in scrapings from the control eye. Scrapings from the six eyelids of three normal rabbits were also negative. In no instance was *P. ovale* isolated in culture. The scaliness diminished gradually but was still evident after 34 days. No spreading occurred. In comparison with the conjunctiva of the control eye, the conjunctiva of the eye inoculated with *P. ovale* was mildly hyperemic.

Ear. *P. ovale* were also inoculated directly, without scarification, onto the ear of a rabbit, and a control yeast onto the other ear. A flaky, loose scaliness developed on the 10th day on the ear inoculated with *P. ovale*. The control side presented a scaliness which was firm and intact. Examination of normal rabbits' ears revealed the same type of firm, intact, scaly surface. Scales from the *P. ovale* side were loose and profuse, particularly in the area of inoculation. No spreading occurred. *P. ovale*-like organisms were readily demonstrated in methylene-blue mounts but no positive cultures were obtained. The scaliness disappeared spontaneously after the third week.

The same place on the same ear was again inoculated 30 days after the first inoculation. Again a loose, flaky scaliness appeared but this time there was also a marked erythema which may possibly

have been a manifestation of sensitivity produced by the previous inoculation.

HUMAN SUBJECTS

Strips of gauze containing growth from a culture of *P. ovale* were placed on the backs of two human volunteers and left in situ for 24 hours.

Patient 1. Results negative after one week.

Patient 2. On the fifth day an area of dry erythema and dry superficial scaling was evident. The lesion did not resemble typical seborrheic dermatitis. The area affected corresponded closely to the application site. No spreading occurred in three days. *P. ovale*-like organisms were found in methylene-blue mounts of scales. No cultures were made.

OTHER YEASTLIKE ORGANISMS FROM BLEPHARITIS

A total of 11 yeastlike organisms, other than *P. ovale*, were isolated from 8 of the 24 cases of blepharitis subjected to culture study. These all appeared similar microscopically and culturally. The colony growth was white and pasty, turning tan and brown with age. There was a typical yeasty odor. Growth occurred readily on Sabaraud's medium, wort agar, and blood-agar plates. In Benham's synthetic medium⁵ growth occurred in the aqueous component, the oil globules remaining clear. Microscopic examination revealed a preponderance of oval forms. Growth first appeared in from 2 to 7 days. After two weeks giant colonies of four strains developed the characteristic "eruption" surface due to gas formation. No ascospores were demonstrated on carrot media. Mycelium formation was studied on corn-meal agar by slide-culture technique. Seven of the strains formed mycelia. These were considered to be members of the *Monilia*-*Mycotorula*

group, and the four which did not produce mycelia to be members of the *Cryptococcus* group. No further identification could be made.

The occurrence of these yeasts in lid-margin cultures raises the question of the identification of *P. ovale* in lid margin scrapings. Can other yeasts simulate *P. ovale*? In an effort to clarify this point, the correlation between the appearance of *P. ovale*-like forms in lid-margin scrapings and the growth of yeasts on Sabaraud's medium, wort agar, and blood-agar plates, was studied in a series of 12 cases. All ordinary yeasts grow readily on these media and, if present in any numbers on the lid margin, would make profuse growth on culture. This was not the case, however, since never more than two or three colonies of yeast developed on these media from any one of the dozen cases, even though yeastlike forms were numerous in scrapings. It is our belief, therefore, that the sporadic yeasts isolated were air-borne contaminants.

DISCUSSION

In looking for a relationship which might be analogous to that of *P. ovale* in seborrheic blepharitis and its secondary conjunctivitis and keratitis, one inevitably turns to a consideration of the role of *Corynebacterium xerosis* in xerophthalmia. It will be recalled that the xerosis bacillus, found constantly in xerophthalmia, was originally described as the cause of the disease. Attempts to reproduce xerophthalmia with pure cultures of the diphtheroid invariably failed, however, and the disease was eventually shown to be due to avitaminosis A. Is it possible that *P. ovale* may play the same saprophytic role in seborrheic blepharitis?

According to the evidence available, the following important differences seem to obtain: (1) Seborrheic dermatitis, unlike xerophthalmia, is almost undoubtedly in-

fectious even though there is as yet no positive proof; (2) *P. ovale*, unlike *C. xerosis*, is not entirely devoid of pathogenicity for animals; and (3) *C. xerosis* is a saprophyte which will grow on almost any medium; whereas *P. ovale*, like many pathogens, is fastidious in its growth requirements. As a matter of fact, it is extremely difficult to isolate *P. ovale* and maintain it in pure culture as it is unable to grow in the absence of lipids. Its growth requirements would be more readily supplied by a parasitic existence via the naturally occurring fatty acids. For these reasons it seems unlikely that *P. ovale* could play a purely saprophytic role.

Etiologic studies in seborrheic dermatitis have been made extremely difficult by the lack of a suitable experimental animal. To our knowledge the direct transmission of seborrheic dermatitis to animals has not been obtained and certainly no one has ever produced with lid-margin scrapings the clinical picture of seborrheic blepharitis and its associated conjunctivitis and keratitis. Even human inoculations have not been entirely satisfactory. Thus it would seem to be almost impossible to fulfill Koch's postulates in this disease.

If Koch's postulates cannot be fulfilled, what are the possibilities for determining etiology? If *P. ovale* is the etiologic agent it should satisfy the following conditions: (1) It should produce the same results in animal and human inoculation experiments as are obtainable with tissue from seborrheic dermatitis. (2) It should be found consistently in the lesions of the disease. (3) It should be absent, unless a carrier state should exist, from the healed lesions.

As reported in this study, *P. ovale* produced a mild dermatitis and conjunctivitis in the rabbit comparable to that produced by scrapings from seborrheic blepharitis;

it was found consistently in the lesions of the disease; and, with a few exceptions only, it was absent in clinically normal lids. The demonstration of skin sensitivity to *P. ovale* extract in certain individuals indicates, moreover, that the organism produces inflammation irrespective of its role in seborrheic dermatitis.

Noteworthy in this study was the occurrence, in rare instances, of a very severe conjunctivitis and keratitis in association with seborrheic blepharitis. Eight such cases are reported and in each *P. ovale* was present in enormous numbers in lid-margin scrapings (fig. 3) and in lesser numbers in the conjunctival secretion (fig. 4). In these cases there were no demonstrable pathogenic staphylococci or other pathogens. The occurrence of a skin reaction to *P. ovale* extract in the three cases tested was significant and suggests the possibility that the conjunctival and corneal lesions were allergic in nature.

Therapeutic studies in seborrheic blepharitis yielded data of interest in connection with *P. ovale*. In the 56 cases in which lid margin scrapings were examined repeatedly during the course of treatment, there was a definite correlation between clinical improvement and reduction in the number of *P. ovale*. When the disease recurred in patients who had been rendered symptom free by therapy, there was invariably a recurrence of *P. ovale* in the scrapings.

SUMMARY AND CONCLUSIONS

1. Seborrheic dermatitis of the eyelids is a common external disease. Ordinarily mild and almost symptomless when not secondarily infected, the disease in its pure form is occasionally associated with a severe conjunctivitis and keratitis. The only constant bacteriological finding in the disease is the presence of *Pityrosporum ovale*.

2. First described in 1874, this as yet unclassified yeastlike organism has been incompletely studied and its role in seborrheic dermatitis remains unsettled. Clinical seborrheic dermatitis does not occur naturally in animals and animal

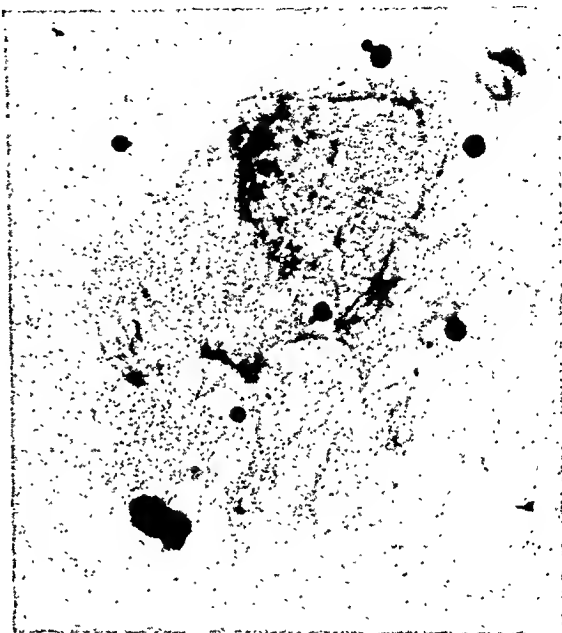


Fig. 4 (Gots, Thygeson, and Waisman). *Pityrosporum ovale* in conjunctival exudate from a case of severe seborrheic blepharitis with associated conjunctivitis and keratitis. Giemsa stain. (Magnification $\times 1,150$).

inoculations with *P. ovale* have failed to reproduce the disease. The few human inoculations recorded have been inconclusive. Difficulties concerned with the isolation of the organism in pure culture and with the recognition of the experimental disease make it impossible to determine on the basis of published reports whether the organism occurs in the lesions of seborrheic dermatitis as a saprophyte or is concerned etiologically.

3. The occurrence of *P. ovale* in scrapings from 100 percent of 143 cases of clinically recognizable seborrheic dermatitis of the eyebrows and eyelids is reported. The organism was isolated in pure culture with difficulty and only on media containing fatty acid, such as oleic-acid-

wort-agar medium. In scrapings the organisms usually appeared in moderate numbers in mild cases and in enormous numbers in severe cases.

4. The morphologic and cultural aspects of the organism isolated from seborrheic blepharitis are described in detail. It is noted that round forms were more common in lid-margin scrapings than in scrapings from infected scalps.

5. Animal and human inoculations with cultures of *P. ovale*, or with lid margin scrapings from seborrheic blepharitis, produced temporary inflammations from which the organism could be isolated, but failed to reproduce the clinical signs of seborrheic dermatitis.

6. Intradermal injections of *P. ovale* extract in 16 individuals without gross seborrheic blepharitis or dermatitis of the scalp produced questionable or negative reactions; in 5 of 46 individuals with seborrheic dermatitis of the eyelids, on the other hand, the injections produced

significant skin reactions. Three of the five showed severe conjunctival and corneal lesions. This suggests the possibility that sensitization may be a factor, particularly in the production of corneal lesions.

7. The present study provided no conclusive evidence that *P. ovale* was pathogenic for the eye and its adnexa but the following findings were suggestive of an etiologic relationship; (1) The constant occurrence of the organism in the lesions; (2) the apparent relationship between the number of organisms present in scrapings and the severity of the clinical disease; (3) the absence of the organism, or its exceptional presence in small numbers only, in clinically normal eyes; (4) the inability of the organism, unlike most saprophytes, to grow on any but complex media; and (5) the demonstration, by intradermal skin tests, of sensitization to the organism.

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CONJUNCTIVITIS WITH MEMBRANE FORMATION*

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It is intended to present: (1) A classification of cases of conjunctivitis which develop membranes; (2) the pathogenesis of membrane formation which accompanies conjunctivitis; (3) case reports of typical examples of membranous conjunctivitis; (4) studies on the pathogenicity of corynebacteria recovered from diseased conjunctivas.

I. CLASSIFICATION OF CONJUNCTIVITIS EXHIBITING MEMBRANES

1. Bacterial

- a. Acute diphtheritic
 - Acute streptococcic
 - Acute pneumococcic
 - Acute meningococcic
 - Acute gonococcic
 - Acute Koch-Weeks
 - Acute *Bacillus coli*
 - Acute *B. faecalis alcaligenes*
 - Acute *B. dysenteriae*
 - Acute Vincent's

- b. Chronic streptococcic
 - Chronic tuberculous

2. Due to viruses

- Acute herpes febrilis
- Acute epidemic keratoconjunctivitis
- Acute vaccinal
- Acute inclusion blennorrhoea

3. Due to higher plant parasites

- Chronic thrush
- Chronic streptothrix

4. Toxic

- Acute—in erythema multiforme
- Acute—in pemphigus

5. Allergic

Acute (transient)—in vernal catarrh

6. Traumatic

7. Chemical

- 8. Due to unknown or uncertain causes
 - Chronic ligneous

II. PATHOGENESIS OF MEMBRANE FORMATION ON THE CONJUNCTIVA

Membrane formation on the conjunctiva may result from a variety of local infectious, allergic, or traumatic lesions. At times it occurs in conjunction with constitutional diseases, or becomes apparent as a result of a general toxemia. Considerable investigative work has been performed to elucidate the nature of membrane formation.¹⁻⁶ It is now well known that the conjunctiva reacts to injuries with the frequent production of membranous lesions. The membrane formation is characteristic in some diseases. This mucosal reaction depends upon the tissue itself, and the duration of action, and concentration of the causative agent. There is ample evidence that the membrane which accompanies infectious diseases is formed exactly as the membrane which follows chemical injuries.² Some agents which are fairly toxic at first produce a light membrane; if their action continues an adherent membrane is formed. Occasional bacteria, such as the diphtheria bacillus, may produce either a catarrhal,^{3, 7, 8} pseudomembranous, or membranous conjunctivitis.

The objective appearance of membranes has caused them to be classified into two main groups: (1) Pseudomembranes, and (2) true membranes.

Pseudomembranes are produced by the coagulation of a fibrinous exudate on the inner surface of the conjunctival epithe-

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lium. Numerous leukocytes, red blood cells, and desquamating epithelial cells are found enmeshed in the fibrin. There is no close connection between this coagulated fibrin and the underlying tissues, so it is easily removed. It should be emphasized that in some diseases, such as inclusion blennorrhea and vernal catarrh these pseudomembranes are frequently transient in duration and seldom recur. At other times, they are more permanent, tend to recur soon after removal, and persist until the toxic agent has been overcome by the tissues. Still others may be of long duration, recurrent in type, and resistant to therapy.

True membranous conjunctivitis is characterized by a massive exudation of fibrin and albuminous fluid into the epithelium and superficial substantia propria. This exudate is also coagulated on the inner surface of the epithelium. In those cases following a milder course, this persists and the membrane undergoes lysis or may be removed with complete healing. More severe cases are characterized by necrosis and the whole membrane may be sloughed off, leaving a raw bleeding surface. The surface may again become covered with a membrane. As the tissues overcome the infection, the membrane ceases to form and new epithelium covers the raw surface. In the most severe cases, toxins or chemicals may produce widespread vascular damage with thrombosis. As a result, considerable sloughing of the conjunctiva may occur with subsequent formation of adhesions between the lids and globe.

III. CASE REPORTS AND DISCUSSION OF THE VARIOUS GROUPS OF CONJUNCTIVITIS

1. BACTERIAL MEMBRANOUS CONJUNCTIVITIS

a. *Diphtheritic conjunctivitis*

Diphtheritic conjunctivitis may occur as: (1) An acute catarrhal conjunctivitis,

(2) a pseudomembranous conjunctivitis, and (3) a true membranous conjunctivitis. Sourdille³ first established the existence of the catarrhal form of diphtheritic conjunctivitis. This form responds readily to treatment with antitoxin. Sourdille^{2,3} and Stephenson⁶ have described a moderately acute form of diphtheritic conjunctivitis which is accompanied by pseudomembrane formation. This type is more severe than the catarrhal form. The symptoms usually subside following administration of diphtheria antitoxin. Most cases of diphtheritic conjunctivitis are accompanied by true membrane formation. Stephenson found membranes in 42 of 43 cases. Of these, 20 cases had a mild form of the disease, 19 were moderately severe, and 3 were severe. He stated that in most instances the patients showed pseudomembranes. The grave form of the disease is nearly always accompanied by true membrane formation, conjunctival necrosis, and sloughing. Corneal complications are frequent in this type of diphtheritic conjunctivitis.

CASE REPORT. *Acute diphtheritic membranous conjunctivitis.* Dr. H. C. I., aged 38 years, was admitted to the Institute of Ophthalmology, Presbyterian Hospital, April 4, 1941.

History. The patient awakened one morning with redness and watering of both eyes. He treated himself with zinc-sulfate drops for two days without improvement. He then shifted to mercurochrome (1 percent) for two days without effect. At this time local treatments with silver nitrate were commenced and within a few days he accidentally received a drop of 10-percent, instead of 1/2-percent, silver nitrate in each eye, which put him in bed for about a week. At the end of this time, conjunctival cultures showed only staphylococcus albus. He treated himself again for another week with mercurochrome but the membranes which had

developed failed to disappear.

Examination. There was a bilateral acute catarrhal conjunctivitis with membrane formation on the lower tarsal conjunctiva (fig. 1). The cornea was normal. Smears revealed numerous organisms having the morphology of *C. diphtheria*. Cultures showed a fair number of colonies possessing the characteristics of *C. diphtheria*. Subsequently, these organisms proved to be *C. diphtheria* by culture and guinea-pig inoculation.

Treatment. He was treated with diphtheria antitoxin intramuscularly and made an uneventful recovery.

Comment. This case presents a typical instance of chronic diphtheritic membranous conjunctivitis, persisting in spite of the ordinary forms of treatment but responding readily to diphtheria antitoxin.

Diagnosis. The diagnosis in acute diphtheritic conjunctivitis should be based upon the finding of typical organisms in smears and in cultures upon Loeffler's media. The virulence of these organisms must be confirmed by intraperitoneal inoculation of guinea pigs.

b. Acute streptococcic membranous conjunctivitis

Streptococcic membranous conjunctivitis may be accompanied by formation of either pseudomembranes or true membranes. The membranes which are encountered in moderate forms of the disease are usually pseudomembranous in type and are either transient or persistent. In these, the membrane appears during the second or third day of the disease, may be diffuse or localized, and principally affects the palpebral conjunctiva. The bulbar conjunctiva and cornea are rarely involved. The membranes persist for the duration of the acute infection.

Other cases⁹ are characterized by an acute fulminating conjunctivitis, edema of the lids, preauricular lymphadenopathy, diffuse palpebral and bulbar mem-

brane formation, early corneal involvement with perforation, and a profuse conjunctival discharge. A number of cases¹⁰⁻¹³ of chronic streptococcic conjunctivitis have been reported in which the infection was characterized by a brawny induration of the eyelids, extensive heavy membrane formation on the



Fig. 1 (Hogan). Diphtheritic membrane on tarsal conjunctiva.

palpebral and bulbar conjunctiva, secondary corneal involvement with perforation, and a strong tendency to form layers of connective tissue in the substantia propria of the conjunctiva. In most of the cases of this type the infection has persisted for 1½ to 8 years. The prognosis is poor as to vision but the conjunctival lesions seem to have been favorably influenced by penicillin, sulfonamides, and antistreptococcic serum.

CASE REPORT. *Acute streptococcic membranous conjunctivitis with corneal perforation.* V. C., a Negro girl, aged seven years, was first seen at the clinic of the Institute of Ophthalmology, Presbyterian Hospital in New York, on November 16, 1942.

History. The patient had an upper respiratory infection which commenced approximately on November 6, 1942. On November 11th, the right eye became inflamed and swollen and developed a yellowish purulent discharge. On the

following day, the left eye became involved in a similar manner. The swelling and discharge increased in amount each day until she was referred to the hospital for care.

Examination. There was marked edema of the lids of both eyes (fig. 2). They could be separated only with difficulty. The bulbar conjunctiva was markedly



Fig. 2 (Hogan). Bilateral streptococcic membranous conjunctivitis.

chemotic. There was a good deal of yellowish discharge. A yellow-white membrane covered the palpebral and bulbar conjunctiva and extended across the cornea. The membrane was heavy and could be lifted only with difficulty, leaving a raw bleeding surface.

Course. The patient was admitted to the Hospital. Smears and cultures on blood agar were taken, and sulfadiazine and sulfanilamide were given by mouth and by local instillation in solution. On the following day the patient was extremely toxic. The blood sulfanilamide level was 15 mg. percent, and the blood sulfadiazine level was 6 mg. percent. The cornea of the right eye ruptured during the afternoon of this day. The left cornea soon showed signs of advanced necrosis and perforated. Subsequent therapy gradually brought the conjunctival infection under control. By January 10, 1942, the membranes had disappeared and the

eyes showed beginning atrophy with extensively scarred granulating corneas.

Laboratory studies. The initial cultures on admission showed a pure culture of beta hemolytic streptococcus on both conjunctivas. Smears showed organisms which were morphologically similar to streptococci. In spite of continuous treatment, the smears and cultures from the membranes and corneas continued to be positive until January 8, 1942. The streptococci recovered from all of these cultures were reported to be in Group A, Type 25 (Lancefield). Subsequent cultures showed only occasional staphylococci and numerous diphtheroids.

Organisms from cultures on blood-agar plates were inoculated into the right cornea of a rabbit by the scratch method and into the left cornea by a penetrating needle. The right cornea developed a gray, 4-mm. nebula which cleared rather quickly. The left cornea developed a severe keratitis with necrosis superiorly and marked bulbar congestion. The infection subsequently subsided with formation of leukomas.

Comment. This case of acute streptococcic membranous conjunctivitis demonstrates the rapidity with which streptococci can invade the tissues, produce a severe inflammatory reaction, and result in corneal necrosis. The membrane formation in this case was in the nature of a true membrane. Streptococcic infections respond to penicillin and the sulfonamide compounds. Those patients treated early should rarely develop corneal complications. Swan and Allen¹⁴ have reported favorably on the use of sulfanilamide in streptococcic membranous conjunctivitis.

c. Acute membranous conjunctivitis due to other bacteria

The membranous conjunctivitis which occurs during the course of pneumococcal, Koch-Weeks, influenza bacillus, gonococcal, and intestinal bacillary infections is usually of the pseudomembranous

ous form. In some instances, the pseudomembrane is permanent and subsides only with healing of the conjunctivitis. In others, such as gonorrheal infections, the membrane is usually transient in character. Gifford¹⁵ stated that the pseudomembrane in pneumococcic infections was usually light and could easily be wiped off the upper tarsus. Morax¹⁶ described four cases of pneumococcic conjunctivitis in children which were unocular and accompanied by thin membranes. Clinically, the membranous conjunctivitis is identical in pneumococcic, influenza bacillus, and Koch-Weeks bacillus infections, and can be differentiated, as a rule, only by laboratory study. Knapp¹⁷ reported a six weeks' old infant with inflamed eyes and fibrinous membranes on the upper lids. The child developed right corneal involvement 12 days after onset of the disease. He was able to culture the influenza bacillus on blood-agar plates, from material removed from the conjunctiva. Yakovleva¹⁸ has reported a family epidemic of acute catarrhal conjunctivitis due to *B. faecalis alcaligenes* and *B. dysentery liquefaciens*. Five cases of the disease developed and of these a 2½-year-old girl had a thick membrane which was difficult to remove. She also had thickened, heavy lids and a profuse purulent discharge.

Comment. The diagnosis in these acute forms of conjunctivitis with membrane formation is usually made by examining stained smears of the conjunctival exudates and by the culturing of the causative organisms on suitable media.

Treatment. It is best to direct treatment toward eliminating the causative organism and providing palliation of the patient's symptoms. The pneumococcus and gonococcus respond to sulfonamides and penicillin administered locally and systemically. Koch-Weeks and influenza bacillus infections usually respond to mild antiseptics and are self-limiting infec-

tions. There is a possibility that conjunctivitis due to intestinal bacteria may be relieved by local streptomycin therapy.

d. Chronic tuberculous membranous conjunctivitis

Most cases of conjunctival tuberculosis are characterized by either ulcerative or nodular lesions. Gourfein¹⁹ reported the case of a six-year-old girl with swelling, redness, and discharge from the right eye. On examination, the upper tarsal conjunctiva was covered with a gray false membrane. It detached with difficulty and resulted in bleeding but there was no underlying ulcer. There was a right preauricular, submaxillary, and parotid lymphadenopathy. Chest examination was negative. The lesion was completely healed in 21 days without complication. Cultures showed only the staphylococcus albus. Guinea pigs were inoculated with bits of the false membrane and died four months later of generalized tuberculosis. The purulent exudate from several glands was also injected subcutaneously into guinea pigs and they died three months later of generalized tuberculosis. Conjunctival secretion was injected into the anterior chamber of guinea pigs with formation of tubercles on the iris and subsequent death of the animals from generalized tuberculosis.

Comment. The course of the disease in the above case is somewhat atypical, and the author does not say whether or not he observed tubercle bacilli in smears from the conjunctiva. However, the animal inoculations in this case are rather convincing, and it must be presumed that the case is actually one of chronic tuberculous membranous conjunctivitis.

2. MEMBRANOUS CONJUNCTIVITIS DUE TO VIRUSES

a. Inclusion blennorrhoea

During the acute phase of inclusion blennorrhoea a pseudomembrane may form on the palpebral conjunctiva both inferi-



Fig. 3 (Hogan). Pseudomembrane in epidemic keratoconjunctivitis.



Fig. 5 (Hogan). Membrane in epidemic keratoconjunctivitis.

only and superiorly. This membrane is temporary and usually disappears within 10 days to 2 weeks. The membrane, at times, may be quite transient. Thygeson²⁰ has pointed out that no sequelae are noted except that marked pseudomembranous infections may be followed by fine conjunctival scars.

b.. Epidemic keratoconjunctivitis

Membrane formation in epidemic keratoconjunctivitis was first reported in 1942 by Hogan and Crawford.²¹ Of their 125 reported cases, 17 patients developed membranes on the conjunctiva of the eyelids.

CASE REPORTS: These 17 patients were seen in the fall of 1941. They all had typical cases of epidemic keratoconjunctivitis and exhibited conjunctival membranes. The membrane made its appear-

ance in each of these patients between the 4th and 8th days after onset of the disease. At first it was thin and milky in appearance and was usually located on the tarsal conjunctiva near the fornix. It could be wiped off easily. In three cases, the membrane persisted in this form for several days and then disappeared (fig. 3). In the other 14 cases, the membrane continued to form and extended medially onto the caruncle and semilunar fold and toward the margin of the lids. In two instances, a thin pseudomembrane occurred on the bulbar conjunctiva inferiorly (fig. 4). As the membrane developed it became more dense and white and in four cases was difficult to remove (figs. 5 and 6). Moderate bleeding occurred after removal. The membrane in these more severe cases usually lasted from 6 to 8



Fig. 4 (Hogan). Thin membrane in epidemic keratoconjunctivitis.



Fig. 6 (Hogan). Membrane in epidemic keratoconjunctivitis.

days. After subsidence of the infection, no scars were noted on the conjunctiva.

Sporadic cases of epidemic keratoconjunctivitis have been seen since 1942, but no instances of membrane formation have occurred until this year. The membrane, in the more recent cases, is thin in appearance and more transient in duration. In addition, we have also noted atypical forms of the disease. Recently a physician was seen who developed a bilateral acute catarrhal conjunctivitis, more severe in the right eye. There was a pseudomembrane on the tarsal conjunctiva of the right eye but none on the left, and there was no preauricular lymphadenopathy. There were fine scattered epithelial corneal infiltrates in both eyes. Laboratory studies showed organisms resembling *C. diphtheria* in smears, but repeated cultures showed only diphtheroids, non-pathogenic to guinea pigs. The patient was treated with diphtheria antitoxin, 40,000 units being given on two occasions. He showed steady improvement and the conjunctivitis was cured within 10 days. He had been treated with penicillin before coming for advice, so that if his infection was originally diphtheritic the organisms were probably gone by the time the above studies were made. At present, this patient shows corneal opacities which are exactly similar to those of epidemic keratoconjunctivitis. The wife of this patient also developed a conjunctivitis but without membrane formation. Her infection was accompanied by epithelial lesions which resembled those of a herpetic keratitis. Laboratory studies on this patient were negative. Five patients of the above physician also developed an acute conjunctivitis during the course of his infection. In these patients a keratitis developed which had the features of a dendritic keratitis.

Comment. The clinical features of epidemic keratoconjunctivitis, together with

the laboratory findings, especially the observation of a predominantly lymphocytic exudate in scrapings, serve to distinguish this disease from most others with membranous conjunctivitis. Treatment in these cases, so far, is of little value except that palliative measures may render the patient more comfortable. Convalescent serum may eventually prove to be of value, especially if given in the early stages of the disease.

c. Herpes febrilis

Clausen,^{22, 23} Aust,²⁴ and Batagnani²⁵ have shown that a catarrhal form of conjunctivitis may occur in herpes febrilis, especially if the patient has lesions on the lid margins. Aust, Loewenstein,²⁶ Granström,²⁷ and Larsson and Granström,²⁸ have reported cases of acute conjunctivitis associated with marginal lid lesions, membrane formation, severe pain, regional lymphadenopathy, and constitutional symptoms. A number of these patients subsequently developed dendritic keratitis or exhibited superficial epithelial corneal infiltrates. Rabbit corneal inoculations with scrapings from these cases were accompanied by development of a keratitis, conjunctivitis, iritis, and, at times, cerebral symptoms. Loewenstein thinks that the infections in these cases originate on the lid margins and result in pseudomembranous conjunctivitis with corneal lesions. Granström and Larsson think the herpes virus must be suspected as a cause of violent cases of unilateral conjunctivitis in which a bacterial factor cannot be proved. They conclude that the development of keratitis, enlarged lymph nodes, membrane formation, and positive rabbit inoculations confirm the diagnosis.

d. Vaccinia

Many reports have been made concerning the development of conjunctivitis and corneal ulcers during the course of smallpox. A number of articles state that the streptococcus is frequently cultured from

the conjunctiva in cases showing the eye complications of smallpox. It is probable that the conjunctival pustules become secondarily infected in many instances, with development of severe ulceration and membrane formation. Almost 100 cases of accidental vaccination of the conjunctiva have been reported. Most of the reported cases have developed the conjunctival lesion as a result of contact with the vaccinia vesicle on other persons (case 2, below).

CASE REPORT. (1) In 1946 a patient was seen who developed an accidental vaccinia of the eyelids accompanied by a membranous conjunctivitis. The patient, a woman, aged 35 years, had been vaccinated on the right arm eight days prior to coming for treatment. She had noted swelling of her right eyelids for three days, with redness and moderate discharge from the conjunctiva.

Examination. There was marked edema and redness of the lids. The conjunctiva was edematous and congested. There was a thin, pale, white, pseudomembrane on the lower tarsal conjunctiva and fornix. The cornea was normal. There was a small nodule topped by several vesicles on the upper lid temporally. A vaccinia pustule was present on the right arm.

Course. The conjunctivitis subsided slowly and the pseudomembrane disappeared from the conjunctiva in five days, without scarring.

CASE REPORT (2). I am indebted to Dr. Margaret Henry for permission to present the findings in this patient. A Negro girl, aged six years, was admitted to the Children's Hospital on April 17, 1946, with the history that three days previously the left lower lid had become swollen. Within 24 hours she could not open her eye. Skin lesions soon appeared on the eyelids and bridge of her nose. Her physician administered 20,000 units of diphtheria antitoxin the following day

and referred the patient to the Hospital.

Examination. The appearance of the left eye was striking. There was marked periorbital edema and cellulitis, extending above the eyebrow, across the nose, and down onto the cheek. There was a watery discharge from the eye, and the lids were covered with a dry purulent exudate. There were several small vesicles on the eyelid and one umbilicated vesicle on the bridge of the nose. There were also a number of vesicles on the lid edges. On retracting the lids, there was a thin pseudomembrane on the lower tarsal conjunctiva near the lid margin and on the upper tarsus centrally.

Course and Treatment. The patient was given another 20,000 units of diphtheria antitoxin intramuscularly. Four days later she was afebrile, and the conjunctival and lid lesions were nearly well. The lesion on the bridge of the nose looked like a primary vaccinia. Five days later the patient developed a small, pinhead-sized ulcer at the 6-o'clock position on the cornea which healed rapidly under treatment with tincture of iodine. She was discharged on April 28th.

Laboratory findings. Repeated cultures and smears of the conjunctiva showed no pathogenic organisms. Throat cultures showed no diphtheria bacilli. The Kahn test was negative.

Comment. There is some debate as to the etiology of this condition, as the child had no history of vaccination. However, she had been playing with cousins who had active vaccinia lesions and she may have contracted the virus from them. She was vaccinated twice while in the Hospital and showed an immune reaction. The clinical appearance of the lesion on the bridge of the nose was rather typical, so that a diagnosis of vaccinia membranous conjunctivitis was made in this case. The experiments of Folk and Taube²⁹ provide ample evidence that vaccinia virus, intro-

duced on the conjunctiva, is well able to produce a membranous conjunctivitis without a previous abrasion. In spite of the severity of the clinical picture in these cases the prognosis is surprisingly good, and most reports indicate that the lesions heal without visual loss in about 90 percent of the cases.

3. MEMBRANOUS CONJUNCTIVITIS DUE TO HIGHER PLANT PARASITES

At times, a conjunctivitis may develop in patients suffering from general debilitating diseases. Cases have been reported in which smears showed fungi or other parasites. Usually other organisms have been encountered in addition to the fungi, and the decision as to the nature of the causative agent is difficult. Most fungus infections of the conjunctiva are granulomatous in form, and rarely become diffuse with membrane formation. Several case reports have been made describing membranes on the conjunctiva due to *Oidium albicans* and the streptothrix.

a. *Thrush*

Norton³⁰ reported the case of a five-year-old boy who exhibited symmetrically placed white growths nasally and temporally outside the limbus in the palpebral fissures. The outer lesions were triangular in shape and the inner ones were smaller and quadrilateral. This case was followed for a month, and the lesions recurred quickly after removal. The conjunctiva beneath the lesions was wrinkled, yellowish, and slightly chemotic. Otherwise, the conjunctiva was normal, and the boy had no symptoms. Smears and cultures showed monilia candida with mycelium and spores. A sister of this boy was said to have the same condition.

Pichler³¹ reported two cases. The first was of a four months' old child having a severe pseudomembranous conjunctivitis and an aphthous stomatitis. The child's nurse was similarly affected orally.

Oidium albicans was found on the membranes. The second case, that of a three-year-old girl with several exanthematous diseases, showed general emaciation and acute conjunctivitis. There was a white dry membrane on the tarsal and bulbar conjunctivas and the corneas. Similar lesions occurred in the mouth and nose. The conjunctival and corneal lesions resulted in scarring and opacification. *Oidium albicans* was found in smears from the conjunctival and oral lesions, but cultures were unsuccessful.

b. *Streptothrix*

May³² reported a patient with conjunctivitis accompanied by a firmly adherent thin, yellow-white membrane. The bulbar conjunctiva was red and thickened. There was an ulcer below the limbus measuring a quarter of an inch in diameter. It was covered by a thin membrane. Smears and cultures were negative, but tissue sections showed the streptothrix.

4. MEMBRANOUS CONJUNCTIVITIS CAUSED BY TOXIC AGENTS

a. *Erythema multiforme*

The first case of erythema multiforme associated with conjunctival lesions was reported by Fuchs,³³ in 1876. Since that time, a large number of cases have been reported.³⁴⁻³⁸

In general, two conjunctival forms of the disease are seen: (1) A mild simple catarrhal conjunctivitis, and (2) a severe membranous conjunctivitis. The onset in most cases is similar to an acute infectious disease with chills, fever, headache, and malaise. The skin lesions are widespread and polymorphous in character. Conjunctivitis, rhinitis, stomatitis, and pharyngitis are frequently seen.

The ocular lesions usually consist of an intense pseudomembranous inflammation of the conjunctiva and corneal epithelium. The prognosis, from an eye standpoint, is frequently unfavorable. Raffin³⁹ has

stated that the lesions are primarily inflammatory, soon become covered with fibrin, and appear as pseudomembranes. Ulceration is not uncommon and symblepharon may occur. Corneal involvement occurs all too frequently. It commences with edema of the epithelium and stroma. Membrane formation follows and leads to ulceration and perforation. Healing always occurs, with a certain amount of atrophy and scarring.

Erythema multiforme is usually due to sensitivity to drugs or sera. Spontaneous cases may occur in young people and in them the causative agent is rarely determined. Most people are agreed that the disease is toxic in origin.

Two cases have been seen during the past few years which have presented the features of erythema multiforme accompanied by mucous membrane involvement. I am indebted to Dr. David O. Harrington and Dr. Margaret Henry for permission to present them.

CASE REPORT (1). A. K., a white man, aged 35 years, was admitted to the United States Veterans Hospital in San Francisco on September 29, 1946, for treatment of cerebral concussion and a compound fracture of the skull. During the course of his treatment he received 30,000 units of penicillin intramuscularly every four hours and 1 gm. of sulfadiazine by mouth every four hours. This was continued for 18 days, at which time he developed a severe generalized dermatitis, characteristic of erythema multiforme. The conjunctival and oral mucous membranes were markedly affected and he had a temperature of 104°F. In spite of the high degree of fever, his white blood count remained at around 5,000 cells per cubic ml., with a normal differential count.

Eye examination. The lids and conjunctivas were markedly chemotic, with a thick tenacious mucoid discharge. A thin pseudomembrane covered the lid and

bulbar conjunctivas. Treatment was symptomatic and improvement was slow. Ulcers formed beneath the pseudomembranes, and there was a marked tendency to form a symblepharon. Attempts to separate the membranes left raw bleeding areas. At first there was no corneal involvement, but as the disease progressed, a gray haze was seen superficially. At the end of 15 days, the cornea was clear and membrane formation ceased. Subsequently it was noted that there were two quite firm adherent symblepharons in the upper and lower fornices of both eyes. There was no limitation of motion of the globes. Visual acuity was normal.

CASE REPORT (2). Mrs. K. A., aged 28 years, was first seen at Children's Hospital on October 10, 1944, complaining of a skin eruption with pruritus, headache, sore throat, and swollen eyes and lips for 48 hours.

History. The patient had been perfectly well until 48 hours before admission, when she noted the signs of an upper respiratory infection, including headache, malaise, a nasal discharge, backache, pains in her legs, and sore throat. Twenty-four hours later a conjunctivitis developed in both eyes, and later the same day puffiness of the lips. She had extreme difficulty in swallowing. Six to eight hours prior to onset of the conjunctivitis she had taken an aspirin preparation containing phenolphthalein. Twelve hours before admission her physician commenced sulfathiazole (2 gm.), followed by 1 gm. every four hours. On the morning of admission the patient developed a scattered rash on the skin. Her family and past medical histories gave no indication of a cause of the present illness.

Examination. The patient was acutely ill. There was a generalized eruption of the face, trunk, and extremities, including the palms of her hands and soles of her feet. The mucous membranes of the eyes were edematous and injected; the mouth

showed a peculiar purplish-yellow discoloration.

Eye examination. The eyes were swollen shut and there was an acute bilateral conjunctivitis with severe photophobia and a serous discharge. The corneas and intraocular structures appeared normal.

Course. The skin and mucous membrane lesions remained very much the same until October 18, 1944 (one week later), at which time the patient complained of inability to see from the left eye. On examination there appeared a rather extensive pale-yellow gelatinous membrane on the conjunctiva of the right eye. A similar membrane on the left eye completely covered the bulbar conjunctiva and the cornea. The membrane over the cornea was lifted up by a serous exudate and air, forming a very extensive bulla. Cultures were taken at this time, and it was seen that the membrane over the left cornea was easily removed with the applicator. The underlying cornea appeared normal. Two days later the corneal membrane was gone in the left eye, but that on the palpebral conjunctiva remained. On October 25, 1944, the conjunctivitis was practically well and there was no secretion. A few white linear scars could be seen on the upper palpebral conjunctiva. The corneas appeared normal. By October 30, 1944, the skin lesions had practically disappeared. The condition of the lips and mouth was still bad, although healing. She was discharged to the care of her family physician at this time.

Comment. These two cases illustrate the development of erythema multiforme accompanied by mucous-membrane lesions as a result of the toxicity of drugs. The course of the disease in both cases was unusually favorable, inasmuch as the corneas were not damaged. The membrane which forms in erythema multiforme is more of the nature of a true membrane, as necrosis of the conjunctiva

occurs and scarring may result. Treatment in cases of this type must be directed along general lines to eliminate the toxic agent. Local therapy should be aimed at preventing corneal complications and symblepharon.

b. Pemphigus

Pemphigus is a toxic disease which may affect the eyes in both the acute and chronic forms. In those cases which present a vesicular eruption on the conjunctiva, the vesicles not infrequently rupture and the fibrinous fluid coagulates to form thin localized membranes. Diffuse membrane formation is not characteristic of pemphigus, but local pseudomembranes may form in the areas of ruptured vesicular lesions.

5. ALLERGIC MEMBRANOUS CONJUNCTIVITIS

a. Vernal catarrh

Thin transient membranes may form on the conjunctiva of the tarsus at any time during the acute phase of vernal catarrh. These transient membranes seem to depend upon the coagulation of a fine film of fibrin on the inner surface of the epithelium. Herbert⁴⁰ mentions that, if the lids are held everted for a short while, a fine membrane may be produced, and that if an examination is made at this time, eosinophils can be found. Lehrfeld^{41, 42} distinguishes the milky film which has been described in vernal catarrh and which is due to the subepithelial hyaline degeneration, from the thick, ropy, lardaceous film which occurs on the mucous membrane in this disease. He states that this tenacious fibrinous membrane is somewhat elastic and can be wiped off without bleeding.

6. MEMBRANOUS CONJUNCTIVITIS DUE TO CHEMICALS

That a membranous conjunctivitis may be produced by chemicals has been shown by numerous observers.^{2, 43} Most of the

original work on the pathology of membrane formation was done following chemical production of the membranes. Jequirity, lime, ammonia, and silver nitrate are the drugs most frequently mentioned as producing membranes. Arsenic administered parenterally may produce a toxic reaction with exfoliative dermatitis and mucous-membrane lesions. Hegner⁴⁴ mentions a patient who received neoarsphenamine and developed an exfoliative dermatitis. A pseudomembranous conjunctivitis occurred, followed by corneal necrosis and panophthalmitis.

The development of membranes on the conjunctiva, following chemical injury, depends upon the ability of the drug to penetrate the epithelium, upon its concentration, and duration of action.

7. MEMBRANOUS CONJUNCTIVITIS DUE TO UNKNOWN OR UNCERTAIN CAUSES

A fairly large number of cases of chronic membranous conjunctivitis have been reported under a variety of titles. In a number of these,⁴⁵⁻⁴⁹ bacteriologic studies revealed organisms, such as staphylococci, streptococci, and so forth. It is probable that most of these chronic membranous conjunctivitis cases are streptococcal in origin.^{13, 50} Among other cases which have been described, the membranes formed over ulcerated areas of the conjunctiva and were followed by granulomatous overgrowths. Later organization of these granulomas led to the formation of dense masses of connective tissue resembling hyaline.

Future cases of this type will probably be classified among the above described groups of bacterial conjunctivitis.

IV. STUDIES OF THE PATHOGENICITY OF DIPHTHEROIDS

In connection with diphtheritic membranous conjunctivitis, an attempt was made to determine if pathogenicity could

be induced in any of the diphtheroids recovered from the conjunctiva. The diphtheroid organisms are generally considered to be saprophytic; and the organisms on the conjunctiva have never been thought to become pathogenic.⁵¹ Numerous experiments designed to determine this pathogenicity have failed. On occasions pathogenic diphtheroids have been recovered in infections occurring in other portions of the body.⁵²⁻⁵⁴

There is evidence that some strains of diphtheroids, such as *C. ovis*⁵⁵ and *C. ulcerans*^{56, 57} produce toxins and that some of these organisms are capable of causing human infections. Reference should be made to the case of chronic membranous conjunctivitis reported by Dunphy⁵⁸ in which organisms of the diphtheroid group were isolated.

METHODS

Corynebacteria were recovered from the conjunctivas of 100 patients with a variety of conjunctival affections. These strains were obtained by implanting smears from the conjunctivas onto rabbit blood-agar plates. Colonies of diphtheroids were taken from the blood-agar plates and implanted in beef broth. After 24-hour incubation at 37°C., a loopful of the broth was spread on blood-agar plates. By further transplantation, pure cultures were then obtained in beef broth. The resulting 48-hour growth of the pure strain in this beef broth was used for morphologic studies, animal inoculations, and fermentation reactions.

The following animal studies were made:

a. Forty-eight-hour broth cultures of each strain were inoculated into the conjunctivas of mice, rabbits, and guinea pigs, one drop at a time at 10-minute intervals, for four hours.

b. One-tenth cc. of a 48-hour broth culture of each organism was injected

beneath the conjunctivas of guinea pigs, rabbits, and mice.

c. One-tenth cc. of a 48-hour broth culture of each organism was injected into the anterior chambers of rabbits and guinea pigs.

d. An equal portion of a 48-hour broth culture of each strain was mixed with an equal amount of *mucin*. Drops of this mixture were instilled into the conjunctival sacs of rabbits and of guinea pigs at 10-minute intervals for four hours.

e. Utilizing the same mixture as in (d) above, 0.1 cc. was injected into the anterior chamber and into the vitreous of mice, rabbits, and guinea pigs.

g. Diphtheria toxin was obtained diluted with saline so that it contained 450 m.l.d. per cc. This toxin was standardized so that upon instillation of one drop into a rabbit's conjunctival sac every 5 to 10 minutes for 2 to 2½ hours, a purulent conjunctivitis could be produced, which subsided within 2 to 4 days. This toxin was instilled into the conjunctival sac of rabbits every 10 minutes for two hours, followed each time by the instillation of a drop of a 48-hour broth culture of diphtheroid organisms. This procedure was carried out with the organisms derived from 10 different patients.

h. The toxin was instilled into the

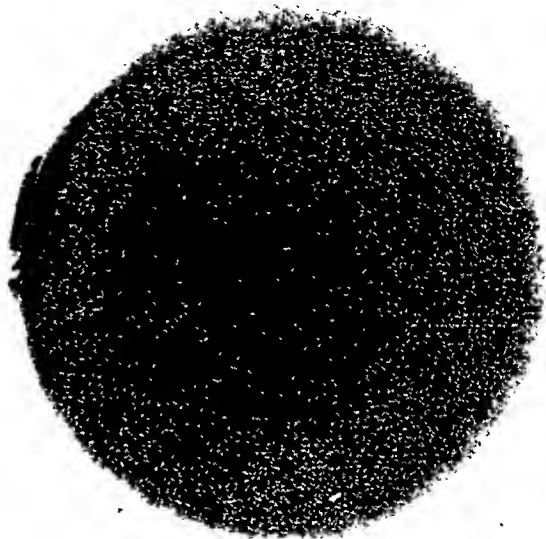


Fig. 8 (Hogan). Large granular colonies of diphtheroids (Magnification $\times 140$).

conjunctival sacs of rabbits and monkeys at 10-minute intervals for six doses. The conjunctival membrane was then lightly scrubbed with an applicator which had been dipped into a broth suspension of diphtheroids derived from five patients.

RESULTS

a. *Colony morphology.* The colony morphology was studied on 24-hour blood-agar cultures. Two main varieties of colonies were encountered in this study, the most frequent type being small, round, flat, and very slightly granular (fig. 7). The other type was larger, more elevated, round, and coarsely granular (fig. 8). This latter type might correspond with the previous descriptions of *C. xerosis* which was described as having a peculiar dryness or scaliness of growth on media.

b. *Cellular morphology.* Three main types of organisms were encountered in this series of cultures: (1) Slender, curved rods of varying length and an irregular staining protoplasm (fig. 9). (2) Small, thick rods, which stained either solidly or were barred and wedged (fig. 10). (3) Coccoid forms (figs. 11 and 12).

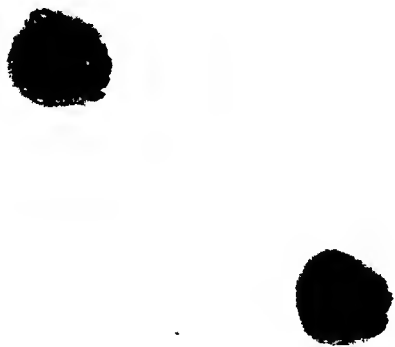


Fig. 7 (Hogan). Smaller granular diphtheroid colonies (Magnification $\times 10$).



Fig. 9 (Hogan). Slender curved diphtheroids (Magnification $\times 1,200$).

The above descriptions apply to 24-hour cultures only. It is well known that after 24 hours, clubbing, irregular staining, elongation, and segmentation are more frequently encountered. No organisms were encountered which fulfilled the essential character of *C. xerosis*; and

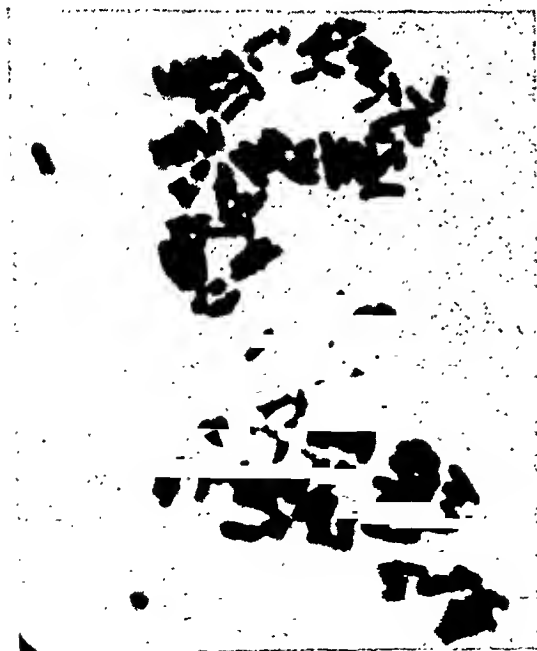


Fig. 10 (Hogan). Short, thick, rodlike diphtheroids (Magnification $\times 1,200$).

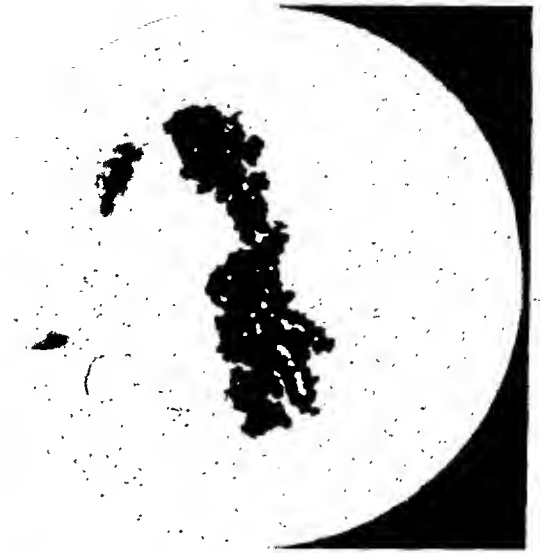


Fig. 11 (Hogan). Coccoid forms of diphtheroids (Magnification $\times 1,200$).

it is doubtful if *C. xerosis* is sufficiently characterized to deserve special mention in reports.

C. Hofmanni fits the description of the second organism (fig. 10), and the cultural characteristics bear out the presence of this organism on the conjunctiva:

c. Fermentation reactions. The tabulated results of fermentation reactions are recorded in Table 1.



Fig. 12 (Hogan). Coccoid diphtheroids (Magnification $\times 1,200$).

d. Animal experiments. In none of these experiments with the cultures of diphtheroids, alone or in conjunction with mucin, or with diphtheria toxin, was it possible to produce any ocular infections.

COMMENTS

It is concluded from these experiments that diphtheroid organisms encountered on the conjunctiva during the course of infectious conditions probably play no part in the production of conjunctivitis and rarely, if ever, contribute to the pro-

duction of intraocular infections. This work confirms previous experiments done on conjunctival diphtheroid organisms. The consideration arose, however, that these diphtheroid organisms might be rendered pathogenic if they could be protected by a substance such as mucin. Similarly, it was reasoned that the virulence might be developed if the resistance of the conjunctiva could be lowered by the use of diphtheria toxin alone or in conjunction with trauma. It was not found to be possible to alter the saprophytic nature of the organisms encountered. It was felt that occasional pathogenic diphtheroids might be encountered which might cause conjunctival disease, such as those described by Gilbert and Stewart and Reudiger.

None of the organisms encountered showed the characteristics of *C. ulcerans*

or *C. pyogenes*. Cultures of *C. ulcerans* were obtained through the courtesy of Dr. Ruth Gilbert of the New York State Department of Health. These organisms invariably produced a rapid and destructive panophthalmitis when injected into the anterior chamber. It was noted that the effects of these injections could be minimized in guinea pigs and rabbits by the administration of diphtheria antitoxin. Unfortunately continued pursuance of this subject was interrupted by the war. Further studies will be made on the

TABLE 1

CULTURAL CHARACTERISTICS OF 100 STRAINS DIPHTHEROID BACILLI

Colony Morphology		Bacterial Morphology			Positive Fermentation Reactions									
Granular	Smooth	Long Rods	Short Rods	Coccoid	Dextrose	Maltose	Galactose	Saccharose	Lactose	Dextrin	Mannitol	Indole	Nitrogen	Liquefied Gelatin
84	16	73	16	11	46	36	18	48	10	23	17	8	35	2

duction of intraocular infections. This work confirms previous experiments done on conjunctival diphtheroid organisms. The consideration arose, however, that these diphtheroid organisms might be rendered pathogenic if they could be protected by a substance such as mucin. Similarly, it was reasoned that the virulence might be developed if the resistance of the conjunctiva could be lowered by the use of diphtheria toxin alone or in conjunction with trauma. It was not found to be possible to alter the saprophytic nature of the organisms encountered. It was felt that occasional pathogenic diphtheroids might be encountered which might cause conjunctival disease, such as those described by Gilbert and Stewart and Reudiger.

effect of *C. ulcerans* on the eye and its relationship to other ocular diphtheroids.

CONCLUSIONS

1. A classification of cases of conjunctivitis which develop membranes is presented.

2. The pathogenesis of membrane formation which accompanies various types of conjunctivitis is discussed.

3. The nature of the membrane formation among the various groups is discussed and case reports are given of typical examples in some of the groups.

4. Diphtheroids from 100 cases of external ocular disease were recovered in pure culture and studied for pathogenicity. No pathogenic organisms were encountered.

5. Attempts to enhance the pathogenicity of diphtheroids by utilizing the pro-

tective effect of mucin were unsuccessful.

6. Attempts to produce diphtheroid infections of the conjunctiva by lowering the resistance of the conjunctiva with diphtheria toxin and trauma were unsuccessful.

7. *C. ulcerans*, an organism recovered from the throat by Gilbert and Stewart produced a panophthalmitis on intraocular injection, but the effects could be

minimized by previously administered diphtheria antitoxin.

Appreciation is expressed to Dr. Philips Thygeson and Mrs. Clement McCulloch for valuable suggestions and assistance in carrying out the work of this paper.

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DISCUSSION

DR. F. H. VERHOEFF (Boston, Massachusetts): I notice that every type of membrane that I have ever seen and some that I haven't are mentioned in the abstract, but a membrane that sometimes occurs in a condition we used to call scrofula doesn't seem to be included. One seldom hears that term used any more. We frequently used "scrofulous diathesis," in cases of children with enlarged glands. Probably tuberculous adenitis was always at the bottom of this condition. Some of those patients, instead of getting phlyctenular conjunctivitis, would have an inflammatory membrane on the palpebral conjunctiva. I wonder whether you are acquainted with such membranes?

It seems to me, several years ago, there was a paper given before this Society on a membranous conjunctivitis of infants. Did you see that?

DR. M. J. HOGAN (San Francisco): Yes, I did.

DR. VERHOEFF: Have you referred to that?

DR. HOGAN: Not in this paper.

DR. VERHOEFF: It was a very excellent paper. The conjunctivitis was of quite a severe type, as I recall it. It was often associated with the formation of a poly-poid growth, wasn't it?

DR. HOGAN: Yes, sir.

DR. VERHOEFF: I noticed reference to experiments on the inoculation of pseudo-diphtheritic membranes in the conjunctiva of animals. If you made such experiments with diphtheria bacilli, I am glad I wasn't around when you did so.

DR. HOGAN: We used diphtheria toxin only.

DR. VERHOEFF: You don't mention it here.

DR. HOGAN: I mentioned it in this abstract.

DR. VERHOEFF: I see. I couldn't hear you well enough to know whether you mentioned it.

DR. HOGAN: Morax, Elmassian, and Sourdille were able to produce membranous conjunctivitis with diphtheria toxin alone or by inoculation of the cultures of diphtheria organisms.

DR. VERHOEFF: I should not have feared being around when you used the toxin, but wasn't it a rather dangerous procedure in the laboratory to have diphtheria bacilli in the conjunctiva?

DR. HOGAN: We did not use the bacilli.

DR. VERHOEFF: I see. Well, perhaps you're lucky.

DR. HOGAN: I did not mention tuberculous membranes of the conjunctiva here, but it is discussed in the paper.

DR. VERHOEFF: And you didn't mention that type of membrane I was speaking about, did you?

DR. HOGAN: No, I eliminated the term scrofulous because I think probably some of those cases would be placed in other groups, either streptococcic or some other form of bacterial or toxic membranous conjunctivitis.

DR. VERHOEFF: I imagine you could put it under those, but we used to call it scrofulous.

DR. PARKER HEATH (Boston, Massachusetts): You mentioned the word "trau-

matic," and I wish you would elaborate on trauma, with or without hemoglobin, forming a membrane.

DR. HOGAN: Most of the cases of membranous conjunctivitis which follow trauma are those in which a child or adult receives a laceration of the conjunctiva, with or without bleeding, in which the membrane forms. A localized membrane may form in the area of the laceration, which, as a transient membrane, of course, is dependent on the healing of the wound.

Usually the wounds are clean, and the formation of a membrane depends on the formation of a fibrin clot within the wound itself.

DR. HEATH: There is a membrane, if I may speak once more, associated with hemoglobin which forms a second membrane, a real membrane, on top, which persists. It is not transient. Have you noted that?

DR. HOGAN, (closing): No, I have not noticed that.

STUDIES ON THE PHYSIOLOGY OF THE EYE USING TRACER SUBSTANCES*

I. THE STEADY-STATE RATIO OF SODIUM BETWEEN THE PLASMA AND AQUEOUS HUMOR IN THE GUINEA PIG

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These studies were undertaken as part of a plan to investigate the permeability of mammalian membranes. The eye is a specially suitable organ for such studies because its fluids can be tapped without appreciably disturbing its normal state. As has been pointed out frequently^{1, 2} the use of radioactive isotopes offers a unique method for permeability

studies. In this first report we shall discuss the steady-state ratio of sodium between the plasma and aqueous humor and in the second report³ we shall discuss the turnover rate of sodium between these two fluids and the methods of analyzing such data.

The steady-state ratio between the plasma and aqueous humor of sodium has been studied by classical chemical methods in several species but not in the guinea pig (table 1), and it is noted that there is little agreement concerning the ratio even in the same species. It is important that the ratio of sodium between the plasma and aqueous humor be accurately determined in order to understand the mechanism of formation of the aqueous humor. If there is an excess of sodium in the aqueous humor, this may be

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explained either by a secretory mechanism or by the loss of water from the aqueous through the cornea. In measurements in guinea pigs of the steady-state ratio using radioactive sodium (Na^{24}) as a convenient ultramicro method, we found the concentration ratio of plasma sodium to aqueous sodium to be lower than that reported for other species.

METHODS

Radioactive sodium (Na^{24}) was prepared in the 60-inch cyclotron of the De-

TABLE 1

DISTRIBUTION OF SODIUM BETWEEN THE PLASMA AND AQUEOUS HUMOR AS REPORTED IN THE LITERATURE

Author	Species	Plasma	Aqueous Humor Na. mgm. per 100 cc.	PL/AQ
Lebermann ⁴ 1925	Rabbit	470	320	1.47
Gaertert and Wittgenstein ⁵ 1927	Dog	328	314	1.04
Tron ⁶ 1927	Ox	331	339	.98
Duke-Elder ⁷ 1927	Horse	145	121	1.20
Baurmann ⁸ 1929	Cow	326	337	.97
Stary and Winternitz ⁹ 1932	Rabbit	303	317	.96
	Horse	333	362	.92
Davson ¹⁰ 1939	Cat	162	156	1.03
Duke-Elder ¹¹ 1936	Cat	160	150	1.07

partment of Terrestrial Magnetism, Carnegie Institution of Washington. Metallic sodium, after deuteron bombardment, was dissolved as sodium alcoholate in 95-percent ethyl alcohol. Sodium chloride was precipitated by addition of concentrated hydrochloric acid. The precipitated sodium chloride was dissolved in water, filtered, dried on a hot plate to remove excess HCl, and the NaCl finally dissolved in a volume of water suitable for injection.

Adult guinea pigs of mixed breeds, weighing between 500 and 1,000 gm., were used. The animals were fed rabbit pellets and fresh greens. Friedenwald and his co-workers have shown¹² that vitamin-C deficient guinea pigs have a lowered rate of formation of intraocular fluid. As a precaution against vitamin-C deficiency in our guinea pigs, each animal received 50 mg. of ascorbic acid 24 hours prior to the introduction of the tracer substance.

Three tenths of a cubic centimeter of an NaCl solution, containing about 1.336 mM/cc. was injected into the peritoneal cavity. After 24 hours, the aqueous was removed with a glass capillary pipette. Immediately thereafter a sample of blood was taken by cardiac puncture. Only brief

TABLE 2

EQUILIBRIUM RATIO PLASMA/AQUEOUS

No.	Pe* mM/kg. H ₂ O	Ae† mM/kg. H ₂ O	Pe/Ae
11	7.680	7.975	0.963
12	.82	.84	0.978
14	1.101	1.137	0.970
15	1.249	1.329	0.937
17	1.069	1.132	0.943
18	.888	1.011	0.878
21 A	1.253	1.365	0.917
27	7.32	7.76	0.943
28	6.45	7.46	0.865
C	5.62	6.14	0.914
K	.717	.755	0.953
L	.717	.834	0.862
	.714	.836	0.854
	.714	.784	0.912
			X=0.920 =0.033

* Pe=equilibrium plasma.

† Ae=equilibrium aqueous.

ether anesthesia was necessary to carry out these procedures.

The weight and radioactivity determination of plasma and aqueous were made in shallow weighing bottles of uniform dimensions. The aqueous was delivered from the pipette to a weighing bottle which was immediately covered. The blood was oxalated and centrifuged

and then 0.1 cc. of plasma was delivered to a weighing bottle. After determination of the wet weight of the aqueous and plasma samples, they were spread uniformly over the bottom of the weighing bottles by the addition of a measured amount of water. The samples were then dried and the dry weight determined.

Measurements of the radioactivity of the samples were made with a pressure ionization chamber connected to a string electrometer.¹³

RESULTS

The beta particles per second per gram of aqueous water or plasma water were calculated and the concentration of tagged sodium was expressed in millimoles of sodium per kilogram of water. The average equilibrium ratio of plasma to aqueous was found to be $0.920 \pm \sigma = 0.03$ (table 1).

DISCUSSION

The Donnan ratio of plasma to body fluid for sodium has been reported to have a theoretical value of 1.04 in dogs (Van Slyke) when all of the sodium in the plasma is ionized. Green and Powers¹⁴ and Ingraham, Lombard, and Visscher¹⁵ have shown by *in vivo* dialysis and by *in*

vitro ultrafiltrates of dogs' plasma that proteins depress the activity of sodium in the plasma by binding it in a nondiffusible form. This removes approximately 8 to 11 percent of the sodium from consideration in the Donnan equilibrium and raises the theoretical value to around 1.12.

If we may transfer these values from the dog to the guinea pig, a considerable difference is evident between the theoretical and experimental ratio. The difference between the theoretical ratio of 1.12 in dogs and our reported ratio of 0.920 in guinea pigs may be due to several factors: (1) A species difference, (2) the passage of water from the aqueous through the cornea to the tears and the subsequent concentration of sodium in the aqueous, and (3) the secretion of sodium into the aqueous by the ciliary body or iris.

SUMMARY

1. Radioactive sodium was used as a tracer to study the distribution of sodium between the plasma and aqueous and between aqueous and lens in the guinea pig.

2. The steady-state ratio; sodium plasma/sodium aqueous was found to be 0.920.

11 East Chase Street (2).

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STUDIES ON THE PHYSIOLOGY OF THE EYE USING TRACER SUBSTANCES*

II. THE TURNOVER RATE OF SODIUM IN THE AQUEOUS HUMOR OF THE GUINEA PIG: METHODS OF ANALYSIS

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One method of characterizing a membrane is to inquire whether the steady-state concentration gradient maintained across it is of such magnitude as would require the expenditure of energy locally in the membrane itself. This is essentially the method of our first paper in this series⁷ in which we measured the steady-state ratio of sodium tagged with radiosodium (Na^{24}) between the plasma and aqueous humor of the eye of the guinea pig and inferred from this ratio that a considerable excess of free sodium is present in the aqueous humor of guinea pigs such that its maintenance might indeed require an expenditure of energy locally at the blood-aqueous barrier.

Another method is to measure the rate at which different solutes cross the membrane. One can then describe the permeability of the membrane with respect to the

physicochemical properties of various ionic and molecular species. One may also study the effect upon the transfer rate of applying a number of different experimental conditions or chemical agents. For these, it is best to study the transfer of a naturally occurring constituent that is intrinsic to the medium bathing the membrane. The tracer technique is ideally suited to this in that one may work with a mere trace of material which does not upset normal ionic or molecular ratios.

We have attempted in the experiments to be reported here to gain a measure of the permeability of the plasma-aqueous barrier to sodium by determining the rate of transfer of sodium into the aqueous humor of the guinea pig using radiosodium (Na^{24}). Particular effort has been made in this initial work to analyze the difficulties involved in calculating rates from tracer data. The analysis is developed by describing two current approaches to the problem, the direct or linear,^{2, 8} and the indirect or exponential methods.^{5, 9}

The indirect method was used by Kinsey, Grant, Cogan, Livingood, and Curtis^{3, 4} for data taken from the rabbit. Our treatment differs from theirs mainly in the more formal manner in which the exponential factors or constants are derived and interpreted. We are indebted to the paper of Merrell, Gellhorn, and Flexner⁵

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and to that of Silversmit, Entenman, and Fishler⁹ for this approach.

Our result for the guinea pig is of the same order of magnitude as that of Kinsey and colleagues for the rabbit in that we estimate that the intrinsic sodium of the aqueous is renewed at the rate of one turnover every hour.

EXPERIMENTAL PROCEDURE

The methods of preparing a neutral solution of NaCl labeled with radioiso-

brief anesthesia was again applied when the aqueous was collected. Blood was taken from the left heart by chest puncture. The blood was always sampled later than eight minutes after the intravenous injection of tracer sodium, at which time the labeled substance had reached a steady value in the circulating plasma (See Figure 2 taken from Merrell, Gellhorn, and Flexner⁵).

DATA

The original data from which calcula-

TABLE 1

THE CONCENTRATION OF TRACER SODIUM IN AQUEOUS HUMOR AT STATED TIMES WHICH BEGAN WITH INTRAVENOUS INJECTION OF THE SODIUM LABELED WITH RADIOACTIVE Na²⁴

Animal No.	Time (Min.)	A* = n* (mM/kg.)	P* _{eq.} (mM/kg.H ₂ O)	A*/A* _{eq.}	P* (mM/kg.H ₂ O)	f _n */P*	k
1	3.8	.515	3.16	0.152	8.33	.0575	.0151
	8.0	.886		0.255	5.68	.145	.0181
2	5.5	.372	2.76	0.126	5.70	.061	.0111
3	5.1	.450	5.47	0.076	11.82	.035	
	7.0	.843		0.143	10.25	.076	.0109
4	8.1	.682	2.60	0.243	4.58	.138	.0171
	15.1	.810		0.289	3.68	.205	
5	10.5	.790	2.36	0.312	3.74	.197	
6	20.5	.386	1.08	0.330	1.41	.254	
8	6.5	1.640	8.70	0.174	16.87	.090	.0139
9	210.0	1.483	1.59	0.868			
10	25.0	1.297	3.01	0.401	3.75	.321	
	46.0	2.080		0.643	3.41	.567	
I	33.5	4.630	9.100	0.473			
E	64.0	1.076	1.383	0.723			
26	76.0	0.712	0.907	0.730			
	91.0	0.733		0.751			
27	45.0	0.900	1.262	0.663			
	60.0	0.979		0.722			
28	12.5	1.840	7.425	0.234			
	39.1	3.600		0.452			
29	66.0	4.120	5.360	0.715			
	91.0	4.580		0.795			

Tracer sodium is expressed in millimoles per kilo aqueous (A* = n*) or per kilo of plasma water (P*_{eq.}), in which the subscript "eq." refers to the steady-state value of tracer. To calculate A*/A*_{eq.}, the proportion of its equilibrium value attained by the tracer in the aqueous at the given time, it was noted that

$$\frac{A^*}{A^*_{eq.}} = \frac{A^*}{P^*_{eq.}} \left(\frac{P^*_{eq.}}{A^*_{eq.}} \right) = \frac{A^*}{P^*_{eq.}} f$$

in which $f = 0.93$ was averaged from several guinea pigs used in our previous work.⁷

dium (Na²⁴) and of sampling the aqueous and plasma are given in the preceding paper.⁷ Less than 1 cc. of labeled solution was injected into a foreleg vein of the guinea pig under brief ether anesthesia. The animal was allowed to recover and

tions or interpretations are to be made are shown in the first five columns of Table 1. The data from the aqueous are also plotted in Figure 1. On the ordinate, instead of plotting absolute concentrations of tracer, we place the proportion of its

equilibrium value attained by the tracer in the aqueous at the time of sampling.

It is not at once apparent how one may calculate the rate of entry of intrinsic so-

damental methods of studying these difficulties.

THEORY

In the first, the *direct method*, the

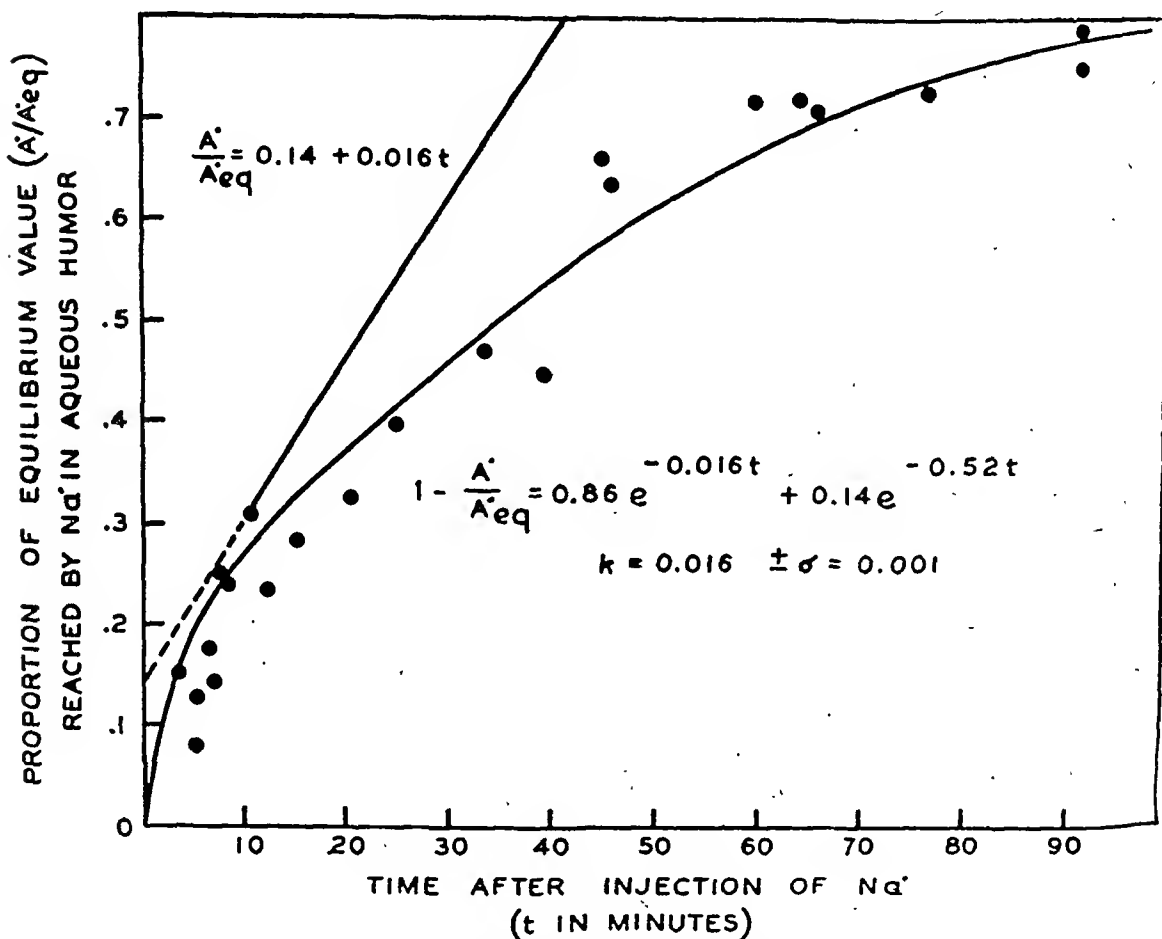


Fig. 1 (Wilde, Scholz, and Cowie). The dots represent the accumulated tracer sodium in the aqueous humor at given time after the intravenous injection of labeled sodium. The upper straight line represents prediction of labeled sodium by the direct method; the lower curve prediction by the indirect (exponential) method.

dium from the rate of accumulation of tracer in the aqueous. Several basic difficulties present themselves. For instance, the measured accumulation of tracer is not a true picture of one-way inflow since some of the tracer which has entered during a finite time will have left the aqueous by outflow. Thus curves for the accumulation of tracer tend to bend toward the horizontal as time elapses and to approach an asymptotic value (fig. 1).

Under *Theory* we will discuss two fun-

amount of tracer accumulated in the aqueous is measured only early after its intravenous injection during which time very little of the tracer which has entered the aqueous has been lost again by outflow. In the second, the *indirect method*, the secondary outflow of tracer is accounted for in the mathematical treatment itself.

THE DIRECT METHOD

In using a tracer substance to measure

transfer rate across a membrane, such as the plasma-aqueous barrier, it is assumed that tracer and intrinsic body substance are transferred across the barrier in quantities proportionate to their concentrations in the plasma bathing the barrier; that is:

$$\frac{P^*}{P} = \frac{\Delta n^*}{\Delta n}, \quad (1)$$

in which P^* and P are the molar concentrations of tracer and intrinsic substance in the plasma at a given instant and Δn^* and Δn are the number of moles of the corresponding substances which during this same instant pass across the membrane from the plasma into the aqueous humor.

This theory holds only for the instantaneous passage of an infinitesimal quantity of tracer Δn^* . Only on two conditions can it be extended to measurements of finite amounts of accumulated tracer n^* in the aqueous. First, over long enough periods of accumulation some tracer can be expected to leave the aqueous by normal channels of outflow. Error in n^* due to this is minimized by collecting aqueous as soon as practicable after the intravenous injection of tracer. Second, once the tracer has been injected, its concentration in plasma P^* is, until equilibrium is reached, continually declining. We must substitute an average value \bar{P}^* estimated from the area under a plasma time-concentration curve. Equation 1 with rearrangement then becomes:

$$\frac{n}{P} = \frac{n^*}{\bar{P}^*} \quad (2)$$

in which n^* is the number of moles of tracer accumulated in a gram of aqueous during the period of observation and n is the number of moles of intrinsic substance which have passed into and out of this amount of aqueous in the same time. It is customary to express this as a fraction of the total substance A , the concen-

tration, in a gram of aqueous. Thus, the fraction exchanged is n/A .

A number of substances reach a steady state or equilibrium ratio between plasma and aqueous. This can be symbolized as:

$$\frac{P}{A} = f \quad (3)$$

If Equation 2 be multiplied by Equation 3, the value P in the left terms divides out, leaving the useful relation:

$$\frac{n}{A} = \frac{fn^*}{P^*} \quad (4)$$

Division by time t during which tracer is allowed to accumulate gives the exchange or turnover rate:

$$k = \frac{n}{At} = \frac{fn^*}{P^*t} \quad (5)$$

THE INDIRECT METHOD

The turnover rate k of a given intrinsic substance in the aqueous humor of the eye is defined as $k = r/A$, in which r is the number of moles of the substance which move by exchange into or out of a gram of aqueous per unit time (note that $r = n/t$ in the notation for the direct method) and in which A is the concentration in moles of the substance in a gram of aqueous. Since A is a constant, it follows that the rate r of movement of substance into the aqueous is equal to the rate r of movement of substance out of a gram of aqueous.

Hence, at any instant beginning from the time of the intravenous injection, the rate of one-way entry of tracer into a gram of aqueous is equal (1) to r , the number of moles of substance entering the aqueous per unit of time multiplied by (2) the proportion of this which is tracer, P^*/P . Meanwhile, the rate at which tracer is leaving the gram of aqueous is equal (1) to r , the number of moles of substance leaving the gram of aqueous per unit time, multiplied by (2) the pro-

portion of this which is tracer, A^*/A .

Thus the net rate of accumulation of tracer is:

$$\frac{dA^*}{dt} = r \frac{P^*}{P} - r \frac{A^*}{A} \quad (6)$$

in which P and P^* are the moles of substance and tracer in a gram of water of the fluid bathing the plasma-aqueous barrier and A and A^* are the respective values for a gram of aqueous humor.

This equation is simplified by noting at once that r/A is the turnover rate k and that r/P can be expressed in terms of k . For most substances, $A/P = f'$ is a constant, an equilibrium ratio across the aqueous barrier. Thus r/P may be set equal to $r/A \times A/P = kf'$.

With these substitutions and rearrangements Equation 6 becomes:

$$\frac{dA^*}{dt} + kA^* = f'kP^* \quad (7)$$

During the first few minutes after intravenous injection of tracer, it remains unknown whether the concentration P^* of tracer presented to the aqueous barrier is (a) identical to that in the plasma or (b) whether P^* is some lower value due to dilution of tracer in a pool of interstitial fluid interposed between the plasma-bearing capillaries and the aqueous barrier itself.

The remainder of the discussion will be limited to a study of the data obtained by using radiosodium (Na^{24}) in the guinea pig.

In case (a) in which P^* is represented by plasma values of tracer sodium, an integral for P^* may be substituted into Equation 7 in a form taken directly from Merrell, Gellhorn, and Flexner.⁵ This is represented in the upper curve of Figure 2 for which $P^* = a e^{-bt} + P^*_{eq.}$ (see notation in legend of figure 2).

With this substitution, Equation 7 is a linear differential equation of the first order (ref. 1, p. 19). Integrating, solving

for the constant of integration, and rearranging after substitution of $A^*_{eq.} = f'P^*_{eq.}$, where $A^*_{eq.}$ and $P^*_{eq.}$ are equilibrium values for tracer sodium per gram of aqueous and per gram of plasma water respectively, gives:

$$1 - A^*/A^*_{eq.} = (1 + L) e^{-kt} - L e^{-bt} \quad (8)$$

in which $L = k/(k-b)$ times $a/P^*_{eq.}$ is a constant.

For case (b), it is desired that the integral substituted for P^* represents the concentration of tracer sodium actually present in the interstitial fluid bathing the aqueous barrier. During the first eight minutes, after the intravenous injection, while tracer sodium is rapidly entering the interstitial fluid from the plasma, the concentration in the interstitial fluid may first rise abruptly and then decline to equilibrium $P^*_{eq.}$. Such a situation would be complex to describe mathematically. We will consider the simplified case in which during the early eight minutes leading to equilibrium in the plasma the tracer which has left the circulating plasma up to any given instant is uniformly mixed in the total volume of interstitial fluid in the guinea pig. The equation for P^* in this situation can be derived either by simple visual inspection of the lower curve of Figure 2 or by a more formal treatment analogous to that used by Merrell, Gellhorn, and Flexner for the plasma curve.

If now this substitution, $P^* = P^*_{eq.} - P^*_{eq.} e^{-bt}$, is made into Equation 7, an integration procedure analogous to that used for Equation 8 yields the equation:

$$1 - A^*/A^*_{eq.} = (1 - M) e^{-kt} + M e^{-bt}, \quad (9)$$

where $M = k/k-b$ is a constant. (In this derivation, we neglect a Donnan ratio across capillary membranes and assume that the concentration of sodium in plasma water is equal to that in interstitial fluid water.)

RESULTS

THE DIRECT METHOD

The quantity of intrinsic sodium exchanged in the aqueous during an experiment (equation 4) is $n/A = f n^*/\bar{P}^*$. The ratio $f = P/A = P^*_{eq.}/A^*_{eq.}$ was measured in a separate experiment as an

sample of aqueous. \bar{P}^* is estimated as follows: The decline in plasma concentration of tracer sodium P^* from the time of intravenous injection until the equilibrium point, beginning in the plasma about eight minutes after injection, is shown in the upper curve of Figure 2. This curve from Merrell, Gellhorn, and Flexner will

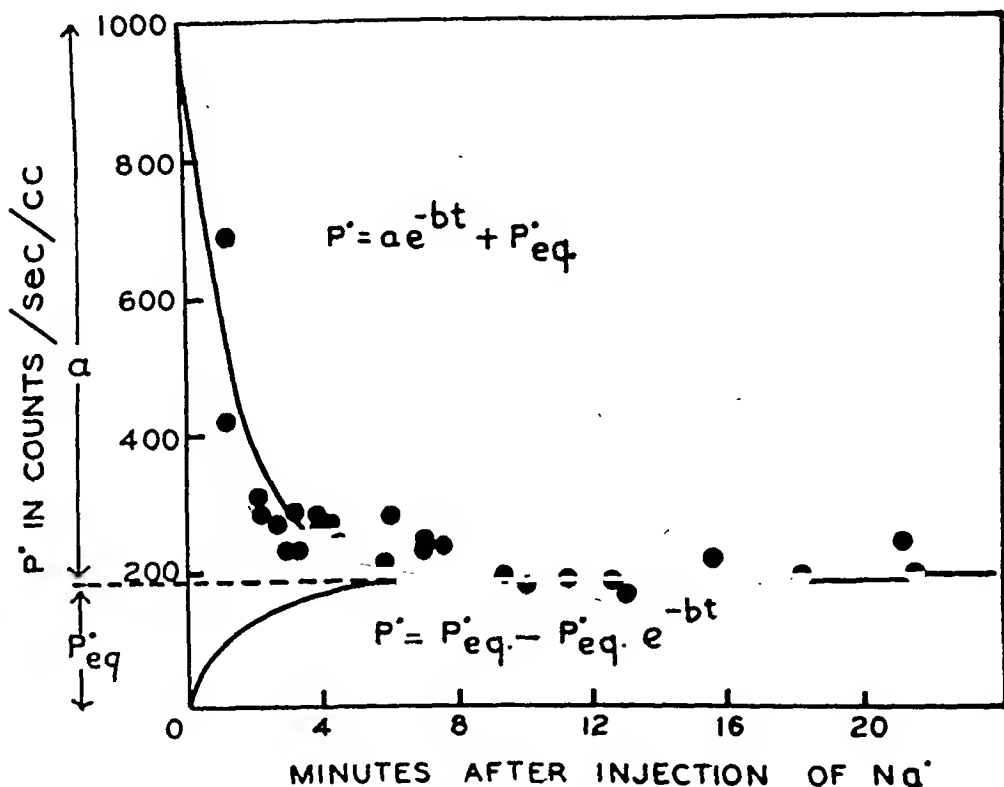


Fig. 2 (Wilde, Scholz, and Cowie). The concentration of tagged sodium (P^* in counts per sec. per cc.) in plasma plotted against time after injection of Na^* into a foreleg vein of guinea pigs. The plotted data, the upper equation, and fitted curve are from Merrell, Gellhorn, and Flexner.⁶ The lower equation and curve represent concomitant "average" concentrations in interstitial fluid (see explanation in text). The transformation from our notation to that of Merrell *et al.* is as follows: $P^* = c_t$, the concentration of labeled sodium in the plasma. $a = c_0 - c_{eq.}$, in which c represents concentration of labeled sodium in plasma: c_0 , at zero time and $c_{eq.}$ at equilibrium in the plasma. As shown by the arrow at the left, a is the concentration of tracer in the plasma at zero time as an "excess" over the equilibrium value in plasma. b is the rate of loss in concentration of plasma tracer substance per minute relative to excess concentration. $P^*_{eq.} = c_{eq.}$. In the symbols on the chart dots are used as superscripts in place of asterisks to identify tracer (for instance $P^* = P^*$).

average from several animals in which tracer sodium was allowed 24 hours after intraperitoneal injection to reach equilibrium between the plasma and aqueous.⁷ In the rate experiment itself the value n^* is measured directly from the given

be called a "standard curve" and was fitted to points from a number of animals, each point being adjusted to an assumed or arbitrary standard dose of tracer sodium.

\bar{P}^* is the average concentration of

plasma tracer presented to the aqueous barrier during the period t allowed for accumulation of n^* amount of tracer. For the standard animal it would be the area under the curve divided by time t . This standard \bar{P}^* and the \bar{P}^* for an animal given a particular dose would be related

$f n^*/\bar{P}^*$ increases linearly with time the secondary loss of tracer from the fetus by outflow back to the mother is negligible. This early linearity for the aqueous is illustrated in Figure 3. It is not clear just where on the plot the linear period ends. Thus for reasons to be discussed later we

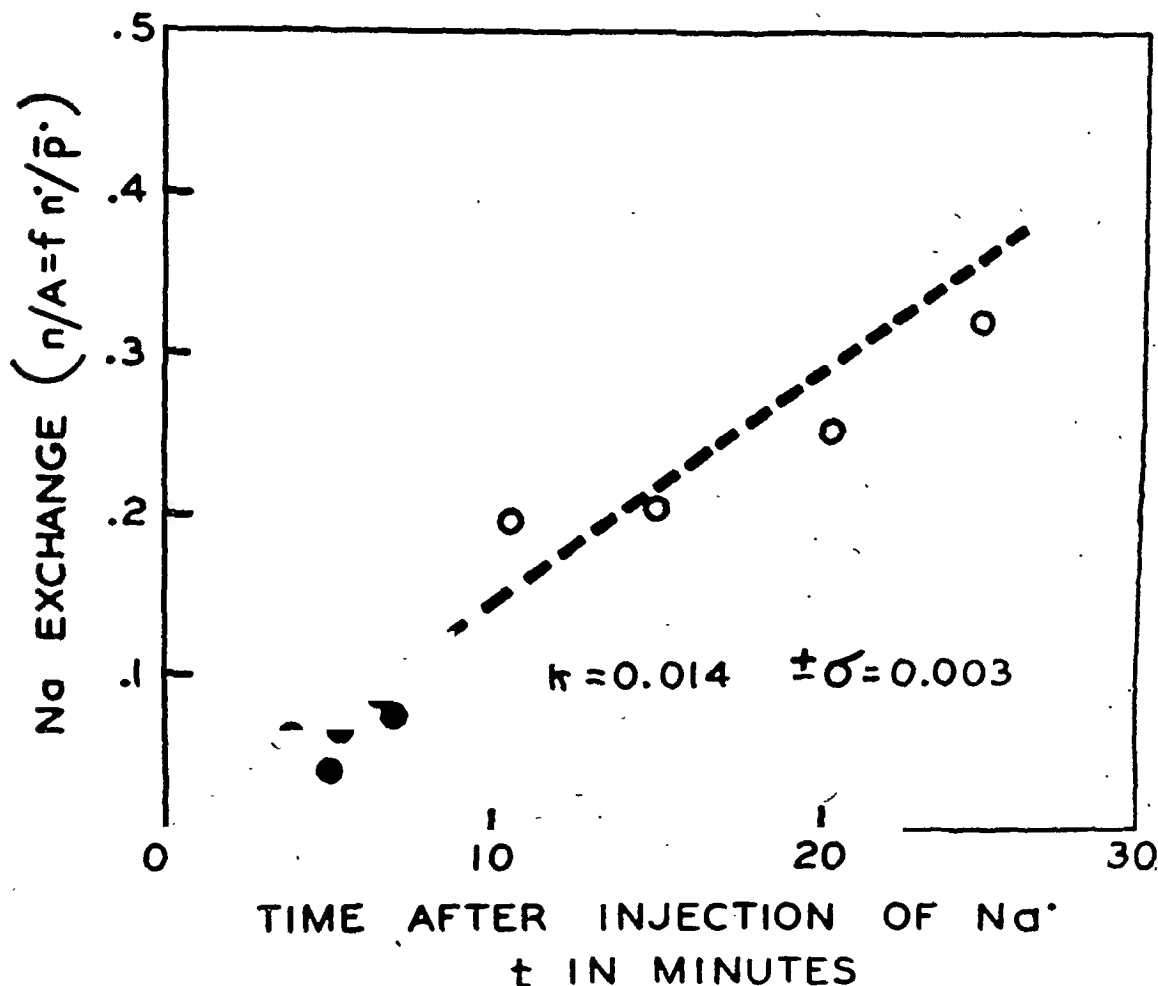


Fig. 3 (Wilde, Scholz, and Cowie). The direct or linear method. The apparent amount n/A of intrinsic aqueous sodium which had exchanged beginning from the intravenous injection of Na^+ until the stated time. Both circles and dots are experimental points but only the dots were used to calculate turnover rate, $k = f n^*/\bar{P}^* t$, as in Table 1. The average k value from these gives the slope of the continuous line drawn arbitrarily through the origin. This line is extended (broken) to show the divergence of later points (circles) because of outflow of tracer from the aqueous.

to each other as are the equilibrium concentrations P_{eq}^* of each.

Values of $n/A = f n^*/\bar{P}^*$ as calculated from Table 1 are plotted in Figure 3.

We have assumed in the studies of placental transfer rate done in this laboratory^{2,8} that as long as the value of

have arbitrarily chosen only points measured earlier than eight minutes after injection to calculate k from Equation 5 in which $k = f n^*/\bar{P}^* t$. The average k for the six animals chosen from Table 1 is 0.014 with a standard deviation of 0.003. This $k = n/At$, which is the turnover

rate, has been used as a slope to draw a line arbitrarily through the origin of Figure 3.

The turnover time corresponding to this k or slope would be $1/0.014 = 71$ minutes for a complete turnover of intrinsic aqueous sodium.

THE INDIRECT METHOD

Equation 8 predicts the value of $A^*/A^*_{eq.}$, the concentration of tracer in the aqueous at a given time as a proportion of the concentration in the aqueous at equilibrium. Values of $A^*/A^*_{eq.}$ estimated from the data of Table 1 are plotted in Figure 1. To fit the theoretical curve to these points the usual device a plot of $\ln(1 - A^*/A^*_{eq.})$ against time is considered. While this at first sight seems complicated by the presence of two exponentials, further examination reveals that one of these, that containing e^{-bt} , approaches zero at eight minutes, the time at which the plasma tracer approaches a steady value. Thus after eight minutes this term drops out and the log of the remaining part yields the linear relation.

$$\ln(1 - A^*/A^*_{eq.}) = \ln(1 + L) - kt \quad (10)$$

A plot of actual $\ln(1 - A^*/A^*_{eq.})$ values indeed demonstrates that the data fit such a linear relation for times later than eight minutes. A line fitted to these later points by least squares has the slope -0.016 which is the value of k or the turnover rate per minute. The standard error of estimate (ref. 6, p. 456) of this slope or rate is 0.001. The turnover "time" is thus $1/0.016$ or 62.5 minutes.

If the straight line portion of this log curve is projected leftwards to the y axis it has the intercept value $\ln(1 + L)$ as indicated in Equation 10. Thus $(1 + L)$ has the numerical value 0.86, which is the value of the coefficient of e^{-kt} in Equation 8. With $1 + L = 0.86$, $L = 0.14$, the coefficient for e^{-bt} .

There remains the calculation of the value of b . Since $L = k/(k-b)$ times $a/P^*_{eq.}$, in which $k = 0.016$ and $a/P^*_{eq.} = 4.525$, the latter being supplied by the paper of Merrell, Gellhorn, and Flexner,⁵ b is calculated to be 0.52.

After substituting into Equation 8 the various values for the constants which have been enumerated above we have,

$$1 - A^*/A^*_{eq.} = 0.86 e^{-0.016 t} + 0.14 e^{-0.52 t}$$

This equation was used to calculate points through which the lower curve of Figure 1 is drawn.

Equation 9 can be fitted by a device analogous to that used for Equation 8. When this is attempted, however, the fitted curve falls far below the experimental points. This implies that the early concentrations P^* of tracer at the functional aqueous barrier are nearer those of the simultaneous declining values in the circulating plasma itself than they are to the ascending values averaged for interstitial fluid as a whole.

DISCUSSION

Error in the direct method caused by tracer outflow. We have mentioned the effect upon the direct method of the outflow of tracer from the aqueous humor. We now show graphically how this error increases with time following the injection of tracer. The lower curve in Figure 1 shows the actual amount, as a fraction of equilibrium, $A^*/A^*_{eq.}$, of tracer in the aqueous at given times. This, as stated, was plotted from Equation 8 which accounts for outflow. The upper line, on the other hand, predicts the amount of tracer, expressed as $A^*/A^*_{eq.}$, which has entered the aqueous one-way, no account having been made for loss by outflow.

The distance between the curves in Figure 1 represents the error of the direct method due to outflow of tracer. At about eight minutes, when $A^*/A^*_{eq.} = 0.25$, when tracer in the aqueous has attained

one fourth of its equilibrium value, the aqueous will have lost by outflow an amount of tracer equal to 11 percent of the tracer in it at that time; when $A^*/A^*_{eq.} = 0.4$, the discrepancy is 24 percent.

In calculating k by the direct method we have thus arbitrarily chosen only points sampled before eight minutes so that the error of outflow would be kept below 10 percent. The direct method gave a k value of 0.014 compared to 0.016 by the exponential method.

The simplicity of fitting the exponential. As one or another experimental condition or agent is tested for its effect upon the turnover rate, it is possible that the agent will be found to change the shape of the plasma curve. To apply the direct method might thus involve the detailed construction of the plasma curve for each agent. To avoid this, as is possible in the exponential method, is a distinct advantage. In the latter method one merely determines approximately how early a steady value is reached by tracer in the plasma. Aqueous values determined later in time may then be plotted as $\ln (1-A^*/A^*_{eq.})$ to determine the slope $-k$, the turnover rate. If it is desired to draw the exponential curve, b can be calculated as previously indicated from the expression for L .

Aqueous values thus measured late in time are of greater magnitude and are more accurately measured than are the smaller early values required in the direct method.

However, warning must be given concerning the collection of data for calculating $A^*/A^*_{eq.}$ from A^* . We have shown in the legend of Table 1 that $A^*/A^*_{eq.} = A^*f/P^*_{eq.}$. Thus, the plotted value $A^*/A^*_{eq.}$ involves three errors: the error in A^* and that in $P^*_{eq.}$ for the particular animal and the deviation represented by the difference in f as averaged from a

series of animals and the f ratio for the particular animal. The effect of this summated error becomes particularly significant if $(1 - A^*/A^*_{eq.})$ approaches zero, at time near equilibrium. Then its \ln value experiences large deviation for small deviation in $A^*/A^*_{eq.}$. One should work with well-scattered points but along the middle range of the time course of the equilibration process for the aqueous.

The effect of early unknown time— P^ values on the direct method.* Precise application of the direct method requires accurate values at known times for the concentration of tracer sodium P^* in the interstitial fluid at the effective barrier to the anterior chamber. To avoid error from outflow of tracer, sampling of the aqueous humor must be done early after the intravenous injection of tracer. This is just the time, during the early decline of plasma tracer, when it is most difficult if not impossible to measure or calculate the value of tracer at the barrier. Furthermore, depending upon the particular channel postulated for the entry of sodium into the anterior chamber, there may be a considerable time lag between the passage of tracer across the barrier and its delivery into the anterior chamber where we sample and measure it. For instance, if sodium enters the aqueous by way of the ciliary body the time for travel from the ciliary body through the posterior chamber and pupil into the anterior chamber where sampled would constitute a considerable portion of the short period allowed for accumulation of tracer in the linear method. These constitute unavoidable errors in the direct method as applied to aqueous.

The indirect method, on the other hand, is deliberately applied late after the injection. At this time P^* is a steady value in the plasma and probably in the interstitial fluid and the posterior chamber, if this latter constitute a pathway of entry

of sodium into the anterior chamber. The slope of the \ln plot of $(1 - A^*/A^*_{eq.})$ constitutes a proven value for k the turnover rate as we have defined it. This k refers to the average rate of the continual passage of intrinsic sodium through a gram of aqueous in the anterior chamber irrespective of the number and nature of the various channels by which sodium may traverse that chamber. The rate is, of course, expressed as a fraction of the total amount of intrinsic sodium in the unit of aqueous.

In the exponential equation itself the effect of the early uncertain P^* values upon the delivery of tracer to the anterior chamber is summarized complexly in the constant L and the exponential factor b .

SUMMARY

The direct or linear is compared with the exponential method of calculating from tracer data the turnover rate of a constituent in the aqueous humor of the eye. In the former, outflow of tracer from the aqueous is ignored; it being minimized by measuring the tracer accumulated in the aqueous only early after its intravenous injection.

A double exponential equation is fitted which accounts for the outflow as well

as for the changing inflow of tracer which attends the declining plasma concentration that follows early after intravenous injection of tagged substance.

Tracer sodium tagged by radioactive (Na^{24}) was injected into the foreleg vein of guinea pigs. In six aqueous samples treated by the linear method the turnover rate was 0.014 ± 0.003 ; in 21 samples calculated by the exponential the rate was 0.016 ± 0.001 . The latter represents a turnover time of 62.5 minutes.

By comparison with the exponential it is shown that the error for the linear method due to outflow is 11 percent by the time the tracer has reached one fourth of its equilibrium value in the aqueous.

Other disadvantages of the linear method not encountered by the exponential as applied to aqueous include: uncertainty concerning the exact value of the early concentration of tracer at the functional aqueous barrier; the error of measuring *small* amounts of accumulated tracer early after the injection; the necessity of precise construction of plasma time-concentration curves for tracer.

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DISCUSSION

DR. VESEY (New York): I would like to ask the speakers if they made any efforts to observe the route of the out-

flow of the aqueous tracer substances from the anterior chamber.

Many arguments could be brought up.

Dr. Troncoso has beautifully shown that the lower animals, on which the experiments are usually carried out, do not have a structure resembling the human ciliary body. He showed that carnivora and rodentia do not have a ciliary body similar to that of human beings. They have a spongy tissue in the ciliary body, and this is the organ that carries the outflow of the aqueous in these animals. In human beings, as I said, many arguments could be brought up against the idea of the ciliary body being the main organ of the outflow, and if any research workers make any efforts to show the route of the outflow, I think our knowledge of the physiology of this very important subject would be enhanced quite a bit. I would like to hear something about that.

DR. WILDE: Well, we have one provisional observation that bears on that question. We have observed, in studying the rate of sodium flow into the lens, that the lens appeared to pick up more sodium than it should had it been bathed in tracer as we measured it in the anterior chamber. In other words, the lens had early been exposed to a tracer concentration higher than that found in the anterior chamber.

This could mean that an early rich batch of tracer was being delivered to the posterior chamber of the eye, and that this rich material was bathing the lens. Of course, it is to be admitted that sodium may have been crossing from the vitreous behind—not saying how quickly it may enter the vitreous. Dr. Scholz may have other comments in this regard.

DR. SCHOLZ: The only other thing that I have to add is that the technique we were using was not directly adaptable to determining the route of outflow—there are other radioactive techniques that might be used but we have not as yet employed them.

DR. DUNNINGTON: Are there any other questions?

DR. WILDE: One other comment in regard to the possible path of flow of tracer into the anterior chamber is that we have entertained the possibility that if the tracer did come by way of the ciliary body, there would be a considerable lag in time as this material went from the ciliary body to the anterior chamber by this pathway.

If I may refer to Slide 6 again, you will see that there is a suggestion of a peculiar early delay. This is only a very provisional type of data, however, in an animal as small as the guinea pig, and when the samples are so small. There is an indication of some delay; perhaps, low values, too early in time, or a tendency to pile up here. Dr. Friedenwald lately has entertained another equation in which it is attempted to account for a stepwise flow of tracer from, say, ciliary body to posterior chamber, and from posterior chamber into anterior chamber, having three exponentials in attempting to explain a problem of that sort. We are greatly indebted to Dr. Louis Flexner and Dr. Jonas Friedenwald for their advice, encouragement, and assistance with this work.

THE SODIUM-VAPOR LAMP AND ITS USE FOR REFRACTION*

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The use of selected portions of the spectrum in ophthalmology is not new. It was early evident that the ill-defined appearance of the eyeground by "white" light was due, in large extent, to the chromatic aberration of the human eye. This led inevitably to elimination of more or less of the polychromatic character of the illumination to obtain an improved fundus picture for certain specific details.

As early as 1903, Mayou¹ employed the mercury-vapor lamp. Vogt² utilized the carbon arc, supplemented by elimination of the infrared end through use of a 30-percent copper-sulfate solution with an added 1 percent of erioviridin to remove the visible red and orange. Friedenwald³ also advocated the use of the carbon-arc lamp and introduced a filter to eliminate all but the yellow and green. Cousin⁴ and Bichelon⁵ further limited the spectral range through filtration of an incandescent tungsten filament to hold the light source at about 5,800 A. U. The first use of sodium light as a monochromatic source occurred with Kleefeld,⁶ in 1935. In all of these various spectral range selections, the light may be considered as "red free," but this is obviously a term of great freedom.⁷

Mayou's mercury-vapor lamp is completely red free but quite rich in the short blue and violet. Under it the fundus appears bluish gray, and the retina, because part of the transmitted spectrum is absorbed and part reflected in a diffused manner, appears largely opaque. Deeper structures cannot be seen as distinctly as

is possible with more nearly monochromatic illumination.

Vogt established the carbon arc together with filtration of the infrared, red, and orange regions, to demonstrate the presence of the yellow pigment of the macula lutea in the living eye, and not solely as a postmortem phenomenon. As late as 1924, his "red free" light was still being used almost exclusively as a selective source of illumination.

Friedenwald in that year believed that "the full value of the control of spectral range of the light used in ophthalmoscopy has not yet been realized." He decided on the use of yellow light because this light is most strongly reflected from the fundus.⁸ For his purpose, it proved advantageous to include some of the yellow-green portion of the wave band to enhance the visibility of certain fundus structures. Friedenwald's filter was a solution of aniline green Naphthol B in glycerin, and with the resultant illumination, the eyeground appeared yellow green, the venous blood as black, and the arterial blood as dark gray. After adaptation, connective-tissue streaks, vessel walls, and exudates appeared in shades bordering on white.

Cousin, Monnier, and Mouton,⁴ in 1933, attempted to prove that yellow headlights on automobiles were superior not only to penetrate fog, but for increased visibility in clear atmosphere. They demonstrated that a certain black object which could be recognized at 130 meters with ordinary headlights was visible at a distance of 160 meters with their selective light. Their bulb contained a tungsten filament at 2,800°C. The filter, consisting of cadmium-sulfate solution, transmitted nearly monochromatic (98 percent) light of 5,820 A. U.

*From the Department of Ophthalmology, Northwestern University Medical School. Aided by a grant from B. Spero for the Sanford R. Gifford Memorial Fund. Read at the meeting of the Chicago Ophthalmological Society, May 19, 1947.

These investigators also used their bulb as illumination for a test chart provided with Snellen letters and Landolt broken circles to ascertain if this light increased visual acuity as well as improving visibility. They reported a 10-percent increase in visual acuity but did not detail how they had arrived at this figure; they also were under the impression that the eye would not so easily become fatigued under yellow illumination, and that its use in factories where detail work had to be done would therefore be advantageous.

In conclusion, they stated that selective yellow light could serve a twofold purpose to the ophthalmologist. It would be superior as source of illumination for test charts, as well as an ophthalmoscopic lamp, since it was less annoying when used for focal illumination. Moreover, the pupil did not contract as much as with ordinary light, and, consequently, fundus details could be made out more easily when a mydriatic was not used. The same light also proved superior for fundus study in cases with cloudy media because of its greater penetrating power.

Bichelonne, Favory, and Bégue⁵ repeated some of the investigations just discussed. Once more, they reported visual acuity increased one tenth, and, again, no specific data as to how they arrived at that figure. They believed the increased visual acuity to be explained by the fact that yellow light omitted the short end of the spectrum. André Broca⁹ had previously demonstrated the increased retinal fatigue accompanying the shorter wave lengths; according to his work the optimum wave length for minimal fatigue would be 5,600 Å. U.

With yellow light as source of illumination, fundus details appeared much more distinct; in particular, the retinal vessels stood out very clearly as did retinal and choroidal changes. These authors also believed that there should be gratifying re-

sults with vitreous opacities, but published their article before substantiating that belief clinically.

Although the filters in all these investigations provided fairly monochromatic yellow light, it is surprising that the sodium-vapor lamp had not been employed before as the one light source that filled, most ideally, this requirement. Certain forms of this type of lamp were available for more than a decade, the first attempts reaching back to 1919 when A. H. Compton of the Westinghouse Company applied for a patent.¹⁰ Kleefeld⁶ had been experimenting with infrared light and its application to fundus study. Technical reasons slowed up his progress and, in an endeavor to turn his research efforts into more promising fields, he was the first one to employ the sodium-vapor lamp in ophthalmology, investigating its possible advantages for focal illumination, retinoscopy, examination with the plane mirror, indirect and direct ophthalmoscopy, and photography of the anterior segment. So far as retinoscopy was concerned, the reflected light appeared grayish white. The reflex was very distinct and one was not forced to observe it in the area of the disc, as in retinoscopy with ordinary light. It was quite easy to perform retinoscopy in the foveal region (obviously, Kleefeld performed his retinoscopies without cycloplegic).

This author's statements are quite enthusiastic, listing numerous advantages, and possibly creating the impression that he would prefer to replace the ordinary polychromatic light with the sodium lamp.

Serr,¹¹ who repeated some of Kleefeld's studies, was much less enthusiastic in his conclusions. He found the direct method of ophthalmoscopy unsatisfactory (naturally he had to use a nonilluminating type of ophthalmoscope), and his findings are based on results obtained by indirect ophthalmoscopy.

Serr reported that where opacities of the refractive media existed, it was still possible to obtain a fairly distinct view of the fundus where polychromatic light allowed only a vague glimpse. This characteristic of sodium light was expected, since the refracting media become more transparent as the wave length increases.¹² Furthermore, sodium light was particularly suited to old people since the yellow-brown discoloration of the lens did not absorb this light to any extent. Of course, even sodium light did not permit visualization of the eyeground where the opacities exceeded a certain intensity.

Serr further reported that in instances of corneal scars, fresh infiltrates of the cornea, extensive deposits of keratic precipitates in uveitis, exudates, and fibrinous deposits on the anterior surface of the lens, as well as vitreous opacities and hemorrhages, surprisingly many fundus details could be seen with sodium light against only an indistinct outline of the optic disc with white light. Serr found that sodium light penetrated living tissue, like the pigment epithelium, making choroid vessels appear distinct. There was a wide zone missing in the yellow portion of the absorption spectra of hemoglobin and oxyhemoglobin. Since, ordinarily, their walls were transparent, the retinal veins and arteries appeared black or gray respectively. For this reason, irregularities in the caliber and formation of anastomoses were brought out very distinctly. Likewise, hemorrhages and pigment deposits stood out very clearly—although it was not possible to differentiate them by their color but only by their configuration. In retinal detachment, a tear, appearing gray, could readily be differentiated from the black of a hemorrhage. Unlike the red-free light of Vogt, sodium light did not allow observance of the yellow color of the macula lutea.

With this light the retina was complete-

ly transparent, there were no reflexes, and not even the nerve fibers could be traced. The choroid absorbed a large part of the light; whatever portion reached the sclera was reflected and underwent further absorption on its return passage giving the choroid a grayish appearance. Serr observed evidence of choroidal hemorrhages in almost every case of severe contusion of the globe which could not be visualized by other means—not even the “red-free” light of Vogt.

Ballantyne,¹³ during a visit of the British Ophthalmological Society to the Research Laboratory of G. E. C. Wembley in 1936, became acquainted with the sodium-vapor lamp and its possible use for ophthalmoscopic work. His conclusions, drawn from investigations made simultaneously but without knowledge of that by Kleefeld, were most complete and illuminating. His report agreed with those of other authors already mentioned, except that, contrary to Serr's statement, Ballantyne was under the impression that the course of the nerve fibers radiating from the disc could usually be fairly clearly traced. He stressed very emphatically that color values could not be appreciated in sodium light. The pigmentary changes in myopia, for example, were transparent, and a melanoma of the choroid disappeared under sodium light.¹⁴

Glueck,¹⁵ contrary to a majority of opinions, believed that corneal opacities, as a rule, would not become more transparent with sodium light. Those resulting from interstitial keratitis were the exception, and he considered this fact as of almost diagnostic significance. Glueck did not mention a universal increase in visual acuity, but noted that patients with opaque media could see better when test types were illuminated with sodium light. He usually succeeded in enabling the patient to gain “a degree” in reading the test types by use of sodium light. He further

stated quite emphatically that he could see no advantage of sodium light in ski-ascopy but neglected giving reasons for these conclusions which were exactly contrary to Kleefeld's experience.

From the discussions so far, it is quite evident that in none of the previous investigations was the primary object to study the possible implications of the use of sodium light as a source of illumination in retinoscopy. Illumination of the test objects was done only in a very cursory manner. There was only a certain curiosity to see "what would happen" if sodium light was used. It is surprising that sodium light has not been investigated more thoroughly in connection with retinoscopy since, for theoretical reasons that have not heretofore been stressed, it seems to be singularly suited for this.

The human eye is not an achromatic optical instrument, as was first noted by Wollaston, in 1801. The amount of chromatic aberration has been variously reported as 1.3D. by Young, 1.5 to 3.0D. by Fraunhofer, and 1.8D. by Helmholtz.¹⁶ Under ordinary conditions, this aberration does not interfere with clear vision; in fact, it requires special arrangements to demonstrate this phenomenon.

In ordinary daylight, the human eye supposedly focuses for the yellow part of the spectrum.¹⁷ Thus it is myopic for the shorter wave length of the spectrum and hyperopic toward the red end. The most widely accepted explanation for this is that the yellow part of the spectrum is appreciated subjectively as its brightest portion, and that, in decreased illumination, relative brightness shifts toward the yellow-green region. A number of subjective methods for refraction are based on the chromatic aberration; for instance, the cobalt-glass test and its various modifications, and Brown's duochrome test. The principle of these tests is to offer two fields, the one illuminated by shorter, the

other by longer, wave lengths than the yellow. It is impossible to have both fields in focus simultaneously. However, when both of them appear equally distinct—more correctly, equally blurred—the yellow supposedly is in exact focus. These methods are widely used among refractionists, and have proved to be valuable assets. Yet it seems that it would be more logical and more practical to use light of the specific wave length in which we are interested than to obtain our result by "interpolation."

In retinoscopy, interpretation of the refractive state of the eye is based on that portion of the spectrum that is reflected from the fundus; that is, light above 5,760 Å. U.¹⁸ Still that leaves a large portion of the spectrum subject to a chromatic aberration of possibly one diopter. Furthermore, subjective vision should be more distinct with sodium light as the source of illumination, and it should be much easier for the patient to decide exactly what spherical correction gives the best visual acuity. If this holds true for distance vision, it should be even more decisive at close range. Whereas the patient has to accommodate for the exact distance at which the test chart is presented when only monochromatic light is available, it is possible that with polychromatic illumination little or no accommodation is called into action if the violet portion of the light reflected from the reading chart is utilized at reading distance.

In an emmetropic eye (or one that is made emmetropic by correcting lenses) the punctum remotum for the short end of the spectrum is approximately 23 inches, which means that only $\frac{3}{4}$ myodioter of accommodative effort would enable an individual to read at 16 inches with complete comfort. For the same result $2\frac{1}{2}$ myodioters of accommodation are required for the sodium line of 5,900 Å. U.

It is known that there is such a phenomenon as "paradoxical" accommodation. Patients with aphakic eyes surprisingly often are able to read quite well at close range with their distance correction. The interpretation for this phenomenon is that these eyes utilize the violet end of the spectrum.

The investigations about to be discussed were undertaken to determine whether or not elimination of chromatic aberration would bring about improvement in our present method of refraction.

PROCEDURE OF INVESTIGATION

SOURCE OF LIGHT

The Gates sodium-vapor unit, manufactured by the George Gates Company in Long Island City, New York, was selected as the source of light. The model equipped with a reflector for illumination purposes was used and, when further provided with a metal screen with a small hole in the center, served as retinoscopy light as well (fig. 1).

Strictly speaking, this lamp is not monochromatic, but the maximum output is between 5,889 and 5,895 Å. U. Some of the other wave lengths emitted fall outside the visible spectrum, and need not be considered here. The remaining 2 percent of the visible spectrum can be neglected as insignificant. The light is very brilliant; it produces about 650 lumen after a brief warming-up period, and will deliver approximately 300 foot-candles at one foot. This illumination is in excess of what is considered adequate. However, visual acuity is little influenced by intensity of illumination within wide limits.¹⁸ An ordinary 25-watt electric bulb served as source of polychromatic light for the control tests, and, by varying the distance of both sources, the amount of reflected light from the visual-acuity chart could

be adjusted to two foot-candles for either light.

METHOD

There were 55 patients, ranging in age from 12 to 56 years and averaging 29 years. Most of them were university students, and excellent cooperation was ob-

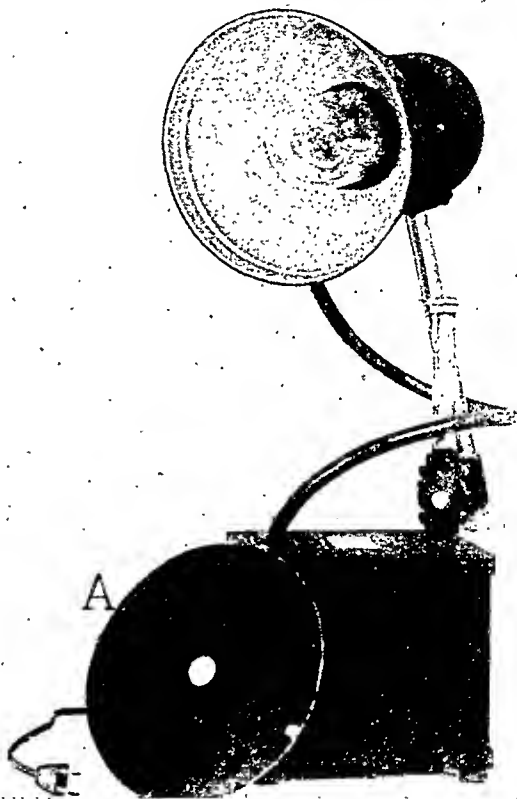


Fig. 1 (Van Wien). The Gates sodium-vapor lamp and the cover (A) used to convert it into a retinoscopy lamp.

tained when subjective tests and discrimination of details were involved. Two drops of 2-percent homatropine and one drop of 1-percent paredrine were used, and the examination started approximately one hour after instillation of the last drop.

1. Retinoscopy was performed with sodium light, and the procedure repeated with polychromatic light. The exact distance of one meter was marked off to eliminate any possible discrepancy in find-

ings due to an error introduced by performing the retinoscopy at different distances. No attempt was made to determine the point of neutralization, but the first lens that would reverse the movement of the shadow was noted. A plain mirror served as retinoscope.

2. The test was performed by deducting one diopter from the retinoscopic find-

4. The postcycloplegic test was performed 5 to 8 days later. First, white light was used, and every effort made to obtain the best possible visual acuity. Only then was it determined whether there was the same, better, or poorer vision with sodium light. Again, every effort was made to improve the vision by changes in the spherical correction.

TABLE 1
RETINOSCOPIC FINDINGS FOR SODIUM AND POLYCHROMATIC LIGHT

+ $\frac{1}{2}$ D. More With Polychrom. Light	+ $\frac{1}{2}$ D. More With Polychrom. Light	Identical Findings	+ $\frac{1}{2}$ D. More With Sodium Light	+ $\frac{1}{2}$ D. More With Sodium Light	Total
5 (4.5%)	29 (26.4%)	72 (65.5%)	3 (2.7%)	1 (0.9%)	110 (100.0%)

ings that were obtained by both sources of light. The Snellen chart was first illuminated by polychromatic light and then by the sodium-vapor lamp. If there was a discrepancy between the retinoscopic findings for white and yellow light, both values were used with both sources of illumination. No change was made in the cylindrical correction but, if the visual acuity could be improved, changes in the spherical values were made, and the correction that would give the best visual acuity recorded.

3. In every instance, an attempt was made to determine the "punctum proximum," that is, the closest distance at which the smallest print could be read. If possible at all, the same size print was used for yellow and ordinary light. Quite frequently, however, a smaller size print could be read at a closer distance with one source of light than a larger size at a farther distance with the other. In this way, the determined values were still of a qualitative, though not quantitative, significance. The distance correction that gave the best visual acuity was worn for this test.

5. The punctum proximum was determined for white and yellow (the distance correction was worn by the patient for this test).

It appeared more appropriate to evaluate the objective results according to individual eyes rather than patients because, in most instances, there was a difference between both eyes.

The retinoscopic findings, both for polychromatic and sodium light, were almost identical. The slight differences are tabulated in Table 1.

The subjective results—both visual acuity and preference for either form of illumination—depend to some extent on the judgment of the patient. Allowance should be made for some uncertainty in discriminating small details when dealing with untrained observers. Of the group, 70 percent gave excellent coöperation; 14 percent were hesitant but did not contradict themselves; and 16 percent contradicted themselves more than once, but did not have to be excluded as unsatisfactory. Of the total of 55 patients, six did not return for a postcycloplegic test. Thus, complete data are available for 49

cases concerning the subjective test under both cycloplegic and postcycloplegic examination.

RESULTS

In presenting the results for the near test it must be considered that their value under cycloplegia is open to criticism. It was reasonable to expect that with the eyes under the influence of cycloplegia, one would be unable to read even large print at a rather short distance. Therefore, it was surprising to note that most patients were able to read relatively small print at a fairly close range. Possibly the strength and amount of homatropine used

as follows: The "near point" was identical for nine of them under both forms of illumination, slightly closer for two under sodium light, and definitely closer for 12 under white illumination. For the determination of the actual near point during the postcycloplegic test, patients requiring presbyopic correction were excluded, leaving a total of 44 cases. The near point for white and sodium light was identical for 41 of these and only slightly closer under white illumination for three.

COMMENT

According to all investigators of the subject, there seem to be definite advan-

TABLE 2

SUBJECTIVE PREFERENCE AND VISUAL ACUITY FOR CYCLOPLEGIC AND POSTCYCLOPLEGIC TESTS

	Subjective Preference	*Better Visual Acuity
White for cycloplegia and postcycloplegia	0	0
Sodium light for cycloplegia and postcycloplegia	21	6
White for cycloplegia, Sodium light for postcycloplegia	2	0
Sodium light for cycloplegia, White for postcycloplegia	3	0
No preference for cycloplegia, Sodium light for postcycloplegia	5	3
No preference for cycloplegia, White for postcycloplegia	5	3
Sodium light for cycloplegia, No preference for postcycloplegia	8	5
White for cycloplegia, No preference for postcycloplegia	1	1
No difference for cycloplegia or postcycloplegia	4	31
<i>Total</i>	49	49

* Visual acuity was considered "better" if one or both eyes could see at least four additional letters.

was insufficient to effect complete cycloplegia. Nevertheless, although there was some residual accommodation left, the figures were, at least, of relative value, inasmuch as there was considerable interference with the accommodation. Only a small number could not be tested at all because the cycloplegia was so complete that they were unable to read even the largest print of the near test chart at closer than 40 inches under either form of illumination. Five patients were excluded because their answers varied—possibly due to a clonus of the ciliary muscle. The data for the remaining 28 subjects were

tages in the use of sodium light for ophthalmoscopy. However, the pathologic changes that could be examined most advantageously with this form of illumination were minute, and could be seen with much greater ease in direct ophthalmoscopy. The sodium lamp, in its present form, is well adapted as a source of light for indirect ophthalmoscopy. In direct ophthalmoscopy, the self-illuminating ophthalmoscope has so many advantages that it seems doubtful whether ophthalmologists, even to obtain added information about minor details, could be induced to resort to the rather cumbersome tech-

nique of using reflected light. It is obviously impossible to incorporate a sodium lamp into the head of the customary hand ophthalmoscope. To incorporate a sodium lamp into a Gullstrand type of binocular ophthalmoscope does not present insurmountable difficulties, but would add another costly piece of equipment to the already vast instrumentarium of the oculist. The relatively few advantages that can be expected hardly justify the recommendation of such an instrument, even for large clinics.

The sodium lamp is an ideal source of monochromatic light since for all practical purposes it emits only the D1 line of 5,897 and D2 line of 5,891 Å. U. It is also within the fraction of the spectrum that is reflected from the choroid. So it is not surprising that it was chosen as a very convenient and eminently practical source. Still, other forms of monochromatic light would have been just as suitable. It could be argued that thallium, with its single emission line in the green part, would be just as satisfactory. There are other emission spectra (especially if used with filters) that could be mentioned.

Retinoscopy, if performed with monochromatic light, of necessity requires that exact wave length for which the eye supposedly is focused. Sodium light fulfills this prerequisite as we know it and should, therefore, be the ideal source of light for retinoscopy if any advantage is obtainable from use of monochromatic light.

No different results could be expected from those obtainable with polychromatic light but it was anticipated that the point of neutralization or reversal would be more distinct with sodium light. This expectation, in the author's experience, did not materialize—an unexpected and entirely disappointing result.

On the contrary, retinoscopy with polychromatic light was just as distinct, and

no advantage whatsoever could be discovered by using sodium light. As indicated in Table 1 results were identical in 65.5 percent of the cases. In 31.0 percent of the cases, there was a tendency towards the positive side with white light, but in 26.4 percent, this difference amounted to only $\frac{1}{4}$ diopter, and to $\frac{1}{2}$ diopter in only 4.5 percent of the cases. In 3.6 percent, the findings tended toward the positive side with yellow light, the difference amounting to $\frac{1}{4}$ diopter in 2.7 percent. Although precautions were taken to perform the retinoscopy at exactly one meter, a difference of $\frac{1}{4}$ diopter was still considered within the limits of possible error. This leaves only six cases (5.4 percent) with a difference of $\frac{1}{2}$ diopter—a surprisingly small number. Of 38 eyes that showed variations, 27 (24.5 percent) accepted the findings obtained with white light, 11 (10.0 percent) those for sodium light. In other words, if any conclusions could be drawn at all, findings with polychromatic light were slightly more accurate.

For the postcycloplegic test, this tendency was slightly reversed to favor sodium light. It was interesting to note that quite a number of patients subjectively preferred sodium light. This might have been partly because the contours are somewhat softer with the latter, partly because the patients, although unaware of the purpose of the examination, were overly eager to cooperate, and decided in favor of the novel and unusual form of examination.

Of the 49 cases with complete data for cycloplegic and postcycloplegic tests, 21 (42.9 percent) expressed preference for sodium light on both occasions. This contrasts with six patients (12.3 percent) who actually showed better visual acuity. None of them expressed preference—or showed increased visual acuity—for

polychromatic light on both occasions. The 31 (63.3 percent) who showed no actual difference in visual acuity, contrast with 21 (42.9 percent) who, subjectively, preferred sodium light and four (8.2 percent) with no subjective preference for either light during cycloplegic and post-cycloplegic tests. The remainder of the results in Table 2 are within such limits as can be expected from an investigation of this kind, and, consequently, require no further comment.

The question as to whether there is a selective accommodation for a specific portion of the spectrum is quite involved, and cannot be answered by conclusions that are based on only one particular wave length. However, it is felt, if such a phenomenon actually exists, the findings, even for this one particular wave length, would demonstrate such a tendency. No such tendency existed with the accommodative mechanism intact.

Of 44 cases, 41 (93.2 percent) had the identical near point for white and yellow. However, of 28 patients whose accommodation was paralyzed (or at least greatly impaired) by the cycloplegic, 12 (42.85 percent) showed a definitely closer "near point." This is more than a coincidence, and is regarded as additional proof for the actual existence of "paradoxical accommodation."

A number of patients whose visual acuity was less than normal, were tested with white and yellow light. Some of these patients had only refractive errors. In others, the vision was actually impaired by opacities of the media. In all of these, the visual acuity was better with sodium than with polychromatic light. It is reasonable to assume that the improvement was due to the elimination of the chromatic aberration. This is an analogy to the improvement of vision by means of a stenopaic disc, and to the elimination of

spheric aberration. Possibly, this may explain why a small number of patients actually had better vision with sodium light, namely, there may have been a slight error in their refraction, which if corrected, would have caused identical visual acuity for white and yellow.

Just as much as spheric aberration is not corrected by the wearing of stenopaic spectacles, sodium lighting is not the answer to the elimination of chromatic aberration. So far as these investigations indicate, no advantage is obtained through the use of the sodium lamp for interior illumination; where improved visual acuity has resulted from installations of this nature, it is believed that closer investigation would have disclosed errors of refraction which if corrected would have provided equal visual acuity under polychromatic illumination.

SUMMARY

1. Certain advantages for funduscopy with sodium light reported by previous investigators are enumerated. These advantages are due to the greater penetrating properties of monochromatic light.
2. Results of retinoscopy, both with sodium and polychromatic light have been compared. No essential difference was encountered, and no advantages could be discovered in favor of sodium light.
3. With proper corrections, no increased visual acuity could be observed with sodium light.
4. With the ciliary mechanism intact, no evidence was noted that there is selective accommodation for the yellow portion of the spectrum.
5. Under cycloplegia, print can be read at closer distance with white light, and this may be additional proof for the so-called "paradoxical accommodation."

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INTRAEPITHELIAL EPITHELIOMA OF THE CORNEA AND CONJUNCTIVA (BOWEN'S DISEASE)*

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The clinical and pathologic entity on which the condition known as intraepithelial epithelioma is based was first described in two cases of chronic skin tumor by the dermatologist, Bowen,¹ in 1912, as a precancerous dermatosis. Since then, many reports of similar lesions in both skin and mucous membrane have appeared, and the condition has come to be known as Bowen's disease. In 1939, Stout² wrote an excellent summary of the cases in the dermatologic literature and, in 1940, Cippollaro and Foster³ similarly reviewed the reported cases of mucosal lesions.

It remained for McGavie⁴ to recognize this condition in tumors of the cornea and conjunctiva and, in 1942, he published a report of five cases with clinical and gross and microscopic studies. The characteristic lesion on cornea and conjunctiva which he described consists of "slightly elevated, diffuse, sometimes multiple, highly vascular patches of reddish-gray gelatinous tissue—which arise from epithelium and may remain entirely within the epithelium for years without breaking through the basement membrane to show the usual tendency of epitheliomas to invade or metastasize."

Microscopically, these tumors showed loss of an orderly arrangement of the epithelial cells, which were hyperchromatic and variable in size with mitotic figures and giant cells containing either clumped nuclei (Bowen cells) or a single

giant nucleus; intact basement membrane, and a degree of inflammatory reaction in the submucosa.

Complete surgical excision was given as the treatment of choice, and radiotherapy was quoted as being contraindicated in the opinion of some pathologists, but McGavie did dwell on the difficulties of complete excision short of enucleation where the conjunctiva is also involved.

A sixth case was reported by George Wise,⁵ in 1943.

A seventh case of Bowen's tumor of the conjunctiva was reported by Khanolkar,⁶ in 1946. Repeated excision resulted in recurrences, of which the last showed malignant changes. Radium application was followed by no recurrence for the remaining four years of this patient's life.

CASE REPORT

P. G., a 63-year-old Puerto Rican woman, was admitted to the Eye Clinic of the Manhattan Eye, Ear, and Throat Hospital, service of Dr. R. T. Paton, on May 21, 1946, with a history of growth on the right eye of five months' duration. There was no previous history of ocular injury or inflammation.

Eye examination. The left eye was normal, with clear media and negative findings for the fundus. Visual acuity was 20/40 with the illiterate chart, due principally to poor coöperation. The right eye showed a visual acuity of 10/200, which could not be improved. The bulbar conjunctiva was slightly injected. In the lower nasal quadrant of the cornea and crossing the limbus was a mass (fig. 1), about 5 mm. in diameter and elevated

* From the Eye Department (Service of Dr. R. T. Paton) and the Radiotherapy Department of the Manhattan Eye, Ear and Throat Hospital. Read before the New York Society for Clinical Ophthalmology, February 3, 1947.

about 1 mm. It was pinkish gray in color, with a slightly granular surface and the texture of a cauliflower. In the surrounding cornea, including the pupillary area, there was a faint grayish infiltrate, and the bulbar conjunctiva and episclera immediately adjacent to the tumor were

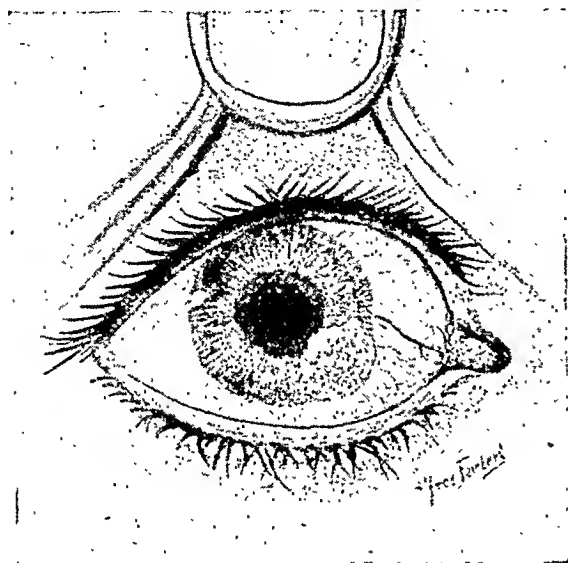


Fig. 1 (Esterman, Laval, and Okrainetz). Intraepithelial epithelioma of the right cornea and conjunctiva before radiation.

more congested than the remainder of the eye. There were no keratic precipitates, cells, or flare. Ocular tension was soft. Dilation of the pupil revealed a faint, posterior, cortical lens opacity and a clear vitreous. The fundus was not perfectly visualized, but there was no gross pathologic condition. There were no palpable regional lymph nodes.

Physical examination. The general physical examination was essentially negative except for a soft systolic murmur at the cardiac apex; and slight transverse cardiac enlargement; blood pressure was 144/86 mm. Hg, urine was normal, Wassermann and Kahn tests were negative; blood sugar was 125; X-ray studies of skull, lungs, and long bones showed no evidence of tumor or erosion.

Laboratory report. On May 23, 1946, a portion of the tumor was excised for biopsy. The report by Dr. Joseph Laval follows:

"The low power (fig. 2) shows proliferation of the epithelial cells without any involvement of the corneal stroma or any other ocular layers. There is no inflammatory reaction and no hemorrhagic factor. The mass has a fairly well-defined external limiting surface with no evidence of necrosis or secondary infection. The high power (fig. 3) shows the basement membrane well defined, with no break through of any of the epithelial cells. Occasional mitosis is present. There are no pearl formations, or evidence of keratinization. No giant cells are seen and no so-called "monster cells" are present. The picture is typical of Bowen's intra-



Fig. 2 (Esterman, Laval, and Okrainetz). Low-power photomicrograph of biopsy; intraepithelial epithelioma of right cornea.

epithelial tumor in all respects except that no monster cells were found. I do not know whether the absence of monster cells is enough to throw out the diagnosis of Bowen's tumor of the cornea, but because the remainder of the picture is typical, I am inclined to consider this case one of Bowen's tumor."

Treatment. Since the tumor involved conjunctiva as well as cornea, it was de-



Fig. 3 (Esterman, Laval, and Okrainetz). High-power photomicrograph of biopsy: intraepithelial epithelioma of right cornea.

cided to attempt radiation. Accordingly, beginning May 29, 1946, under the direction of Dr. Okrainetz, the patient received nine treatments of low voltage unfiltered X-ray therapy in fractionated doses of 600r. every other day for a total of 5,400r. in 18 days. Under pontocaine anesthesia the lesion was screened off with lead foil leaving an exposed area of 1.5 by 1.5 cm. Using 60 K.V.; 5 Ma.; no filtration; target skin distance 10 cm.; H.V.L.: A1-0.4 mm.; output 610r. per minute, each treatment lasted 1½ minutes.

During the course of therapy, the patient had moderate hyperemia of the bulbar conjunctiva and slight pain which was promptly relieved by boric-acid ointment. After a few exposures, the lesion became thinner and at the end of the

course of treatments the tumor had entirely disappeared.

Results. On July 30, 1946, six weeks after completion of radiotherapy, the right eye was white except for a barely perceptible injection of the bulbar conjunctiva in the lower nasal segment of the globe. The tumor mass on both the cornea and the conjunctiva had melted away completely (fig. 4) leaving only the faint infiltrate previously seen and a few small deep vessels originating from the limbus. On the surface of the cornea, at the site of the growth, there remained a very shallow depression, 0.5 mm. at its deepest point.

Dilation of the pupil revealed no increase in the lens opacity noted prior to radiation. Ocular tension had remained soft. Visual acuity was unchanged.



Fig. 4 (Esterman, Laval, and Okrainetz). Reproduced from a Kodachrome of the right eye taken after completion of the radiotherapy.

In November, 1946, the condition was unaltered, except for a slight increase in superficial vascularization originating from the limbal vessels at the tumor site, resembling a pseudopterygium. The most

recent examination (September, 1947) shows this condition to have remained substantially the same, with no lens changes.

CONCLUSION

This case will, of course, require a longer follow-up period before any conclusions can be drawn as to the efficacy of radiotherapy. It is presented with the thought that it may stimulate others to be on the watch for this type of tumor, which otherwise might be considered basal- or squamous-cell carcinoma, papilloma, or simple hyperplasia; and that, if this form of therapy should prove successful, it may provide a more effective method for treating this type of growth in which there is involvement of the conjunctiva as well as the cornea.

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OCULAR CHANGES IN ACUTE DISSEMINATED LUPUS ERYTHEMATOSUS*

REPORT OF A CASE WITH MICROSCOPIC FINDINGS

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A report of the microscopic findings in the retina, choroid, and optic nerve of a case of acute disseminated lupus erythematosus in which the fundus lesions were observed clinically is sufficiently rare to warrant publication.

As Klauder and De Long¹ point out, lupus erythematosus is an exceedingly rare, chronic, less commonly acute, inflammatory disease of the skin. It is characterized by sharply margined, red or violaceous, variously sized patches. The lesions are found on the face much more commonly than elsewhere. These patches are followed by cicatricial atrophy.

The following clinical varieties have been described: (1) A circumscribed or discoid form; (2) a chronic variety; (3) a diffuse or disseminated variety which may be acute and terminate fatally; (4) a telangiectatic variety; (5) a nodular type.

In the great majority of cases the disease makes its appearance in the chronic discoid form. In this report we are concerned only with the rare Type 3, which is an acute or subacute, often recurrent, type marked at times by widely disseminated polymorphic lesions of the skin and mucous membranes, accompanied by constitutional symptoms. Frequently there is a widespread visceral involvement and a variable clinical picture. As Kierland² pointed out, the Senear-Usher and

the Libman-Sacks syndromes are related to this condition. Although some internists and dermatologists believe that the localized discoid type of lupus erythematosus is a different disease from acute disseminated lupus erythematosus, it is significant that in a third of a series of 30 cases of acute disseminated lupus, Montgomery³ found that the disease started as the chronic localized discoid type. The interest of internists in disseminated lupus erythematosus, according to Stickney,⁴ dates from a paper by Osler,⁵ in 1895, on the "erythema group" in which he emphasized the grave systemic manifestations of a group of cases, many of which were undoubtedly disseminated lupus erythematosus. Since the disease is entirely distinct from lupus vulgaris, and since a tuberculous etiology has not been proved, Rose and Pillsbury⁶ feel that it is unfortunate that the term "lupus" is part of the nomenclature of the disease.

GENERAL MANIFESTATIONS OF THE DISEASE

While the disease is rare, Ludy and Corson⁷ state that acute disseminated lupus erythematosus is rapidly increasing in frequency. The disease has been studied extensively by Stillians,⁸ Matthews,⁹ Rose and Pillsbury,⁶ Stickney,⁴ and others.

In addition to the skin lesions the symptoms are those of a prolonged low-grade fever which fluctuates irregularly.

The skin lesions may precede, accompany, or follow the visceral and systemic manifestations of the disease, or they may

* From the Division of Ophthalmology, University of California Medical School, Berkeley, California. Read at the 82nd annual meeting of the American Ophthalmological Society, San Francisco, California, June, 1946.

[†] By invitation.

be entirely absent. As a rule they are polymorphic and active. The exposed surfaces of the body are the sites of predilection, although no cutaneous or mucous surface of the body is exempt. A wide variety of lesions may occur simultaneously or in succession such as urticarial, eczematoid or erysipeloid areas, purpura, petechiae, purplish or reddish brown macules, bullae, telangiectasis, and ulcers. The most common lesion is the deeply erythematous, swollen patch or plaque of varying size. In acute disseminated lupus erythematosus, a puffy erythematous lesion may appear upon the face, and include a goodly portion of it. There may, for a time, be a sharp demarcation about the eyes and at the frontal hairline, but the eruption soon becomes disseminated and involves large portions of the extremities and trunk. Hemorrhagic, vesicular, and bullous lesions are numerous. When remissions occur, marked atrophy, scarring, or pigmentation may follow subsidence of the acute lesion. Deep subcutaneous abscesses are not infrequently observed. The lesions may resemble a number of cutaneous diseases, such as seborrheic dermatitis, dermatitis venenata, erythema multiforme, Boeck's sarcoid, erysipelas, pellagra, and others.

There is gross evidence of pathologic changes in the endocardium in 30 percent to 50 percent of the cases. The tricuspid and mitral valves are most frequently involved, and show nonbacterial vegetations on the endocardial surfaces. Even though the lesions occur chiefly in the endocardium and pericardium, electrocardiographic examination may show some damage to the myocardium. Acute lupus erythematosus may simulate bacterial endocarditis or acute rheumatic fever; however, the cultures are negative.

Renal involvement occurs in practically every case. The clinical picture may suggest glomerulonephritis, pyonephrosis or

nephrosis, "diffuse" or "interstitial" nephritis, or tubular nephrosis. Urinary findings are not consistently characteristic of any particular type of renal lesion. Baehr, Klemperer, and Schiffrin¹⁰ have described what they believe to be the characteristic renal lesion of the disease, and one which they report having seen in no other condition, with the possible exception of the kidney of eclampsia. This renal lesion consists of a peculiar hyaline thickening (wire loop) of the walls of the glomerular capillaries. These wire loops have been found to contain no amyloid or lipoid material. Accompanying these changes they describe proliferative and thrombotic processes involving part or all of the glomerular vasculature; the picture may resemble that of the embolic glomerulonephritis seen in subacute bacterial endocarditis. Renal involvement has been considered the most common visceral manifestation. Renal insufficiency, however, does not play an important role in causing death, since, as Keith¹¹ points out, severe chronic uremia very seldom occurs.

Patients with this disease also show a leukopenia, anemia, loss of weight, and asthenia, followed by marasmus and cachexia. Stillians⁸ pointed out that the white-cell count may be at a low normal level, and that it fails to rise with elevation of the temperature. When positive blood cultures are obtained, Matthews⁹ feels they are the result of contamination, or are due to a terminal bacteremic invasion by organisms having no causal relationship to the disease.

Lymphadenopathy may be generalized or localized to the cervical region. Both the superficial and deep lymphatic chains may be affected. Enlargement is usually moderate but occasionally glands as large as a fist may be observed. Matthews⁹ found nothing characteristic about these glands in microscopic sections.

It is interesting that Matthews⁹ found the serologic tests for syphilis falsely positive in 17 percent of the cases. The sedimentation is also frequently found to be increased in rate.

Hepatomegalia has been reported as a common finding and is said to result from cloudy swelling, pylephlebitis, or abscess formation. Jaundice may occur but is rather infrequent. Splenomegalia occurs rather frequently but it rarely attains an extreme degree. The splenic enlargement, according to Matthews,⁹ is usually due to infarction. Rose and Pillsbury⁶ have demonstrated that the spleen may show parenchymatous degeneration, acute splenitis and perisplenitis, acute congestion, necrosis with arteriolar obliteration, abscess formation, and infarction.

In the gastrointestinal tract, embolic and thrombotic phenomena occur in the mesenteric circulation and this may result in a picture simulating acute abdominal emergencies and lead to unnecessary surgical exploration. Hematemesis and melena are frequent manifestations of ulcerating lesions in the mucosa of the stomach or intestines. Diarrhea is the commonest gastrointestinal symptom.

This disease also affects the lungs; in fact pulmonary involvement is among the chief causes of death. The lesions found clinically and at autopsy are variable and include pneumonia, abscess formation, gangrene, atelectasis, and infarction. Pleural effusions are common and may be serous, sanguineous, or purulent. Severe tracheolaryngitis has been seen occasionally.

The disease seems to have a predilection for the larger joints, and synovial effusions of a serous, sanguineous, or purulent character may occur. The joint symptoms may resemble those of fibrositis, rheumatic fever, and acute, subacute, or chronic infectious arthritis. Rose and

Pillsbury⁶ also point out that arthralgia may precede or accompany the eruption and systemic phases of the disease.

The mucous membranes may also be involved and ulcerative lesions may occur in the gastrointestinal tract, vagina, bladder, and pharynx, which give rise to alarming hemorrhages. Matthews⁹ reported gangrenous ulcerations in the mouth, tonsils, and pharynx.

As a result of central nervous-system involvement, convulsions may occur even in the absence of renal disease and uremia. The colloidal gold curve may be of the paretic type. Careful pathologic studies of the brain have revealed vascular changes in many instances.

The disease is found in all age groups, but women between puberty and the menopause are in the large majority. In Kierland's² cases, they were predominantly in the 20- to 30-years age group. He also found that 80 percent of the cases having the subacute and acute form of this disease occurred in women. These figures are in agreement with those of other observers.

ETIOLOGY

The etiology of acute disseminated lupus erythematosus is essentially unknown but several possible causative factors have been suggested. Inasmuch as there is a close association with tuberculosis in many of the chronic cases of lupus erythematosus, it has received a good deal of serious consideration as a causative factor. This association is not so evident in the acute form of the disease. According to Stillians,⁸ associated skin lesions of lupus erythematosus never give histologic evidence of tuberculosis. Other writers regard the disease as a manifestation of tuberculous infection or as an allergic response to tuberculo-toxin; this view appears to be based largely upon the following facts: (1) The oc-

casional occurrence of active tuberculous lesions in patients with the disease; (2) the alleged recovery of tubercle bacilli from the blood stream in some cases; and (3) the marked response which usually occurs after tuberculin inoculation. Slocumb¹² has stated that the incidence of tuberculosis in American patients with lupus erythematosus is no greater than that found in any other systemic disease. Bergmeister¹³ and Pilat,¹⁴ respectively, have classified the intraocular lesions as metastatic tubercles in the retina and as acute tuberculous choroiditis. In spite of the above facts and the implications suggested by its name, lupus erythematosus is no longer considered to be of tuberculous origin.

Another theory which has received consideration is that the disease is the result of a generalized toxic reaction similar to the Schwartzman phenomenon. According to Stillians,⁸ Brocq's theory that toxins from infectious foci of various kinds are responsible for the lesions of lupus erythematosus has long been the favorite among dermatologists.

The release of unknown toxic products elaborated in the skin by various physical agents has also been considered as the causative factor. The tendency for acute cutaneous and systemic manifestations to appear or recur after exposure to sun or ultraviolet light, roentgen rays, insect bites, cold, or the intracutaneous injection of irritating substances such as tuberculin has long been known.

Kiel¹⁵ has advanced what he terms the "vascular concept" of the disease. He assumes the presence of a theoretical toxin that has a selective affinity for the vascular system, chiefly the capillaries and to a lesser degree the venules and the arterioles. The action of this toxin produces proliferation of the vascular endothelium with subsequent formation of thrombic, perivascular hemorrhages and edema. These lesions are found in

every structure of the body but occur chiefly in the skin, joints, lymph nodes, bone marrow, lungs, heart, and spleen. Wagener,¹⁶ however, doubts that the type of retinopathy found in this disease is of vascular origin and feels there is a lack of histologic evidence to support the theory.

Stokes, Beerman, and Ingraham¹⁷ advance the hypothesis of an infection-allergy being the causative factor. They conclude that as the discoid type of lesion is expressive of local cutaneous infection-allergy of the follicular inflammatory type, so the acute disseminate type is the clinical type of lupus erythematosus with multiform disseminated cutaneous and systemic lesions resulting from allergic inflammation of the vascular system. The vasculo-allergic type then may be preponderantly local and cutaneous in its manifestations or preponderantly systemic. They admit that the clinical case for infection-allergy is not "massively pro, though there is also little con." As to the nature of the infection to which allergy develops or exists, they admitted that no absolute decision could be "had at this time."

DIAGNOSIS

The diagnosis of lupus erythematosus in the present state of our knowledge of the disease must depend chiefly, as Montgomery³ has pointed out, on the recognition of the cutaneous lesions. It is recognized, however, that acutely ill patients will be seen who present most, if not all, of the systemic signs and symptoms outlined above, but in whom no cutaneous lesions occur. The various manifestations of acute disseminated lupus erythematosus are not fully understood. All the clinical findings have not been satisfactorily correlated and so the diagnosis is frequently subject to some question. In the differential diagnosis of acute disseminated lupus erythematosus

several conditions must be considered. In *chronic discoid lupus erythematosus* the cutaneous lesions are similiar but there are no systemic manifestations of the disease. The chronic cutaneous lesions are typified by small, scaly, atrophic patches of pigmented skin on the face. If the skin lesions become more or less confluent and widespread over the body, and there is an absence of systemic manifestations, the condition is called *chronic disseminated lupus erythematosus*. Cases of chronic lupus, either the discoid or the disseminated type, according to Klauder and Ellis,²⁴ may develop into the acute disseminated form with fatal termination.

The ophthalmoscopic picture seen in Koch and McGuire's case¹⁹ was similiar to that which is seen in periarteritis nodosa and less typically in dermatomyositis. Positive blood cultures are sometimes found in the terminal stages but, as Matthews⁹ points out, it should be emphasized that a terminal bacteremia is not uncommon in disseminated lupus and this should not be interpreted as evidence of subacute bacterial endocarditis. The so-called Libman-Sacks syndrome is at times accompanied by skin lesions identical to those of acute disseminated lupus erythematosus. It seems beyond doubt that those cases described by Libman and Sacks with erythematous facial lesions were examples of acute disseminated lupus erythematosus. Rose and Pillsbury⁶ feel that whether their other cases represent instances of the same disease without erythematous skin lesions must remain uncertain for the present. Thrombocytopenic purpura may precede, accompany, or follow the syndrome of acute erythematous lupus.

COURSE OF THE DISEASE

The clinical course of the acute form of this disease is exceedingly variable. Acute exacerbations and remissions typify the disease. The acute form is usually

fatal in from two months to four years. The onset may be abrupt and the course short and stormy with fatal termination in 6 to 8 weeks, while other cases may be characterized by mild systemic reactions and prolonged remissions during which all cutaneous and visceral manifestations disappear. The course may be dramatically unexpected. According to Rose and Pillsbury,⁶ a moribund patient may occasionally recover or an extremely mild case suddenly become fulminating and rapidly fatal within a few weeks. Renal failure, bronchopneumonia, toxemia, or terminal bacteremia have been reported as the commonest causes of death. Stillians⁸ points out that during the course of the chronic forms of the disease (chronic discoid and chronic disseminated types) fever, albuminuria, bone and joint pains, and malaise are warnings of the onset of an acute exacerbation. The chronic discoid type only rarely exhibits rapid extension or acute visceral dissemination.

THERAPY

Treatment is purely supportive. Many drugs and varieties of therapy have been tried and found to be of little or no avail. In view of the fact that acute dissemination may occur following exposure to sunlight, ultraviolet radiation, X-ray therapy, trauma from irritating and stimulating local applications, all of these procedures had best be avoided. Gold and tuberculin are said to be dangerous in the treatment of this condition. Matthews⁹ has pointed out that it is perhaps better to know what not to do than it is to try a therapeutic regime blindly. Early recognition of the disease and the avoidance of certain dangerous procedures, especially exposure to sun and ultraviolet light, may prevent serious or even fatal exacerbations. O'Leary²⁰ warns that vaccines and serums provoke more unfavorable reactions than do drugs.

GENERAL PATHOLOGY

Mallory²¹ has stated that it is not always possible for the pathologist to make a final diagnosis even in a patient with typical clinical manifestations. Characteristic vascular lesions have been described by Baehr, Klemperer, and Schiffrin¹⁰ as consisting of (a) capillary dilatation with extravasation of blood and serum; (b) proliferative endothelial vascular lesions with thrombus formation; (c) degenerative or necrotizing lesions in the walls of capillaries, arterioles, and venules, often with hemorrhage into adjacent tissues. All three processes may be found in the same case and in any part of the vascular tree. Hyaline capillary thrombi are characteristic and wide-spread according to Rose and Pillsbury.⁶ Montgomery³ feels that the pathologic changes noted in the various internal organs are "essentially that of a toxic process, and except possibly for certain vegetative changes in the valves of the heart as described by Gross in Libman-Sacks syndrome and the so-called wire-loop lesions in the capillaries of the kidney, the pathologic changes in the various internal organs are not specific or diagnostic for lupus erythematosus."

FUNDUS CHANGES

Fuchs²² has stated that various intraocular changes have been described in cases of acute lupus erythematosus. These include papillitis with irregular white circumscribed areas along the retinal veins, acute or healed areas of disseminated choroiditis, and macular involvement with retinal hemorrhages. For the most part the ocular lesions described in the literature have been limited to the retina and choroid, with a number of instances of optic-nerve involvement. There have been wide discrepancies in previous reports as to the types of lesions found in the various ocular structures.

In those cases where the retina showed involvement, the presence of some form of exudate or hemorrhage was regularly found. Prominently mentioned throughout the literature were cotton-wool patches, although in most instances the authors did not refer to them by that term. Such cotton-wool-like exudates were variously described as: fluffy exudates,^{10, 23} soft fluffy exudates,¹⁵ or cloudlike patches.²⁴ Frequently small exudates were referred to as: small white dots in the macular region,¹³ small light-colored spots in the macula,²⁵ small white lesions lying over the retinal vessels in the macular area,²⁶ small irregular yellowish-white elevated spots,²³ or small, round, white, elevated lesions situated underneath a retinal vein.²⁷

Similarly there was no uniformity in the character of the described hemorrhages. More often than not the hemorrhages were small and frequently were located in the macular area,^{19, 23, 24, 26} or near the disc.²³ However, larger hemorrhages were also seen, and Koch and McGuire¹⁹ noted a subhyaloid hemorrhage. Maumenee²³ stated that the distribution of the hemorrhages was not in relation to the white patches, nor to the larger retinal vessels. This finding was consistent with Koch and McGuire's¹⁹ opinion that the hemorrhages were located in relatively avascular areas of the retina, but were, however, in close proximity to the capillaries and to the smaller venules and arterioles, especially the former. Other authors, nevertheless, described them as being perivascular.^{6, 10, 15}

A less consistent finding was retinal vascular disease. Some of the vascular changes listed were: hyperemia of the retinal vessels,²³ sclerosis,²⁴ perivasculitis of the arteries,²⁸ marked periphlebitis and segmented periphlebitis,¹⁹ and areas of complete replacement fibrosis of veins and arterioles.¹⁹

Optic-nerve involvement was sometimes seen, although usually in a late stage of the disease. Ophthalmoscopically the following optic-nerve lesions were described: hyperemia of the optic nerve,¹³ blurring of the disc margins,^{23, 25, 27} papilledema,^{6, 23} primary optic atrophy,^{19, 28} and postneuritic optic atrophy.²⁹ In addition, circumpapillary edema^{10, 19} was seen.

Areas of retinal atrophy were mentioned,^{6, 28} and two authors reported retinal detachment.^{6, 9} Retinal⁶ and subretinal⁹ edema were occasionally present. Pillat¹⁴ found healed tuberculous choroiditic lesions in 16 cases of the chronic form. Three of these cases developed into the acute form, and, of these, two developed "indistinct, slightly elevated, grayish-white or yellowish foci of choroiditis in the posterior part of the fundi." Maumenee²³ found miliary tubercles in one case and choroidal degeneration was observed in one case by Rose and Pillsbury.⁶ Koch and McGuire¹⁹ described superficial choroidal, roundish, gray-white exudates and some they believed to be at the level of the choriocapillaris.

Pathologic studies of the eyes in acute disseminated lupus erythematosus are met with only rarely in the literature. Maumenee²³ studied five cases histologically. In all five cases he found cytoïd bodies in the retina which corresponded to the yellowish-white to white spots seen in the fundi. In addition, two of his specimens showed papilledema and two showed small hemorrhages in the nerve-fiber layer of the retina. In individual instances he found hyaline degeneration of the intima of the arteries typical of arteriosclerosis; hyaline degeneration of the intima of the choroidal vessels; serous exudate in the choroid and hemorrhages in the stroma of the choroid. In all five cases he found round-cell infiltration of the cho-

roid as did Semon and Wolff²⁷ in one case. The latter authors also found partially organized subretinal exudates of inflammatory cells. Goldstein and Wexler²⁸ described a case with optic atrophy in which they found marked degeneration of the media of the retinal arteries, and areas of retinal atrophy showing replacement fibrosis. Kurz,²⁶ like Maumenee, found cytoïd bodies in the nerve-fiber layer. These corresponded in position to the small white lesions which he had seen, ophthalmoscopically, to lie over the retinal vessels in the macular area. He refers to these cytoïd bodies as being in the nature of a varicose hypertrophy or ganglioform degeneration of the nerve fibers. Proliferative endothelial vascular lesions with thrombus formation have not been mentioned in any of the eye reports of this disease. It seems strange that if these vascular changes are a characteristic finding in lupus erythematosus that they do not appear in the retinal vessels.

CASE REPORT

Mrs. L. T., aged 30 years, was admitted to the University of California Hospital in the Department of Medicine under the care of Dr. William J. Kerr on November 19, 1941. The following data have been obtained from his records.

History. The patient had been in good health until September, 1940, when she complained of generalized headaches and lower abdominal pain appearing at the time of her menstrual periods. Two months later the lower abdominal pain became constant and was associated with burning on urination. She presented herself for examination by her family physician who, it is said, found albumin and cells in her urine and that her blood pressure was 140 mm. Hg. She was informed that she was suffering from nephritis and was put on a dietary regime. In the following months she became weaker, complaining of costovertebral angle pain, generalized muscular pains, and continued burning on urination. In April, 1941, she developed a severe laryngitis and a "lump" in the left side of her neck associated with fever. There were periods of troublesome palpitation, occurring two or three times daily lasting from 5 to 20 minutes. She had no dyspnea with these attacks.

Four months before admission she developed severe dizzy spells which were unrelated to po-



Fig. 1 (Cordes and Aiken). Fundus drawing 5 to 6 months before death, showing questionable or mild edema of nasal margin of the disc, cotton-wool patches, hemorrhages, and vascular changes.



Fig. 2 (Cordes and Aiken). Fundus drawing one month before death, showing edema of the disc, small edema exudates, advanced vascular changes, and evidences of thrombosis of small venous branches.

sition or activity. These dizzy spells usually lasted from 30 to 60 minutes and were associated with nausea. Two months before admission she developed what was called a "staphylococcus enteritis" during which time she vomited and passed numerous diarrheal tarry stools. For 2 or 3 months preceding admission, she ran a daily low-grade fever of around 100°F. On several occasions she developed showers of petechial hemorrhages over her body. She continued to lose weight and strength and when admitted was acutely and critically ill; the temperature was 38.7°C.; pulse 125; blood pressure 180/110 mm. Hg in the right arm, recumbent.

Physical examination. The essential features of the physical examination were moderate dehydration; erythematous macular rash over the cheeks, nose, and chest; evidences of mitral and aortic valvular heart disease; clubbing of the fingers; mild enlargement of the spleen, and a tender nodule, 1.0 cm. in diameter over the left forearm, 5 cm. below the elbow. The mucous membranes were uninvolued.

Laboratory tests showed mild anemia, 3,840,000 R.B.C.; evidences of kidney damage; four negative blood cultures. Spinal fluid colloidal gold, 0000000000; globulin, normal; cell count, 2 W.B.C. and 49 R.B.C.

Course of illness. The patient's general course while in the hospital was one of progressive decline with occasional waves of slight improvement. The blood pressure was generally high but on one occasion was as low as 145/95 mm. Hg, and on another occasion was as high as 210/160 mm. Hg. A low-grade septic type of fever persisted. Substernal and epigastric distress developed. A pericardial friction rub was heard. In addition a pleural friction rub was heard in the left lower axillary region, and pleural fluid was found to be present. The temperature rose steadily, she became comatose, the basis of which was assumed to be a diffuse cerebral vascular lesion. The patient died on June 14, 1942, 20 months after the onset of the disease. Clinical diagnosis at the time of death was acute disseminated lupus erythematosus with Libman-Sacks endocarditis.

Ophthalmoscopic examination. During the six months' hospitalization

period the eyes were examined ophthalmoscopically at intervals. There was variable but generally progressive reduction in visual acuity of both eyes. Visual disturbance was most marked and appeared first in the left eye. In the beginning there was questionable or no edema of the discs. Later, edema of the discs was present and persisted to the end. A number of retinal cotton-wool or cotton-wool-like patches (fig. 1) were seen on first examination and were present to greater or lesser amount throughout the period

relatively normal while in others there were marked irregular localized narrowings, even to the point of complete occlusion. Associated with these narrowings was a varying degree of perivascular thickening. Evidences of arteriosclerosis were also present. Toward the end the discs began to show pallor.

AUTOPSY FINDINGS

General pathologic report (résumé). Mitral and aortic valvulitis; abacterial verrucose vege-



Fig. 3 (Cordes and Aiken). (H&E low power) Retina. There is thrombosis of one retinal arteriole in the section. Also two other retinal arterioles show marked intimal thickening with occlusion of the lumen.

of observation. Retinal hemorrhages were for the most part small and irregular in shape; some were situated in the deeper layers of the retina; others showed striations and were flame-shaped, indicating their location as being in the nerve-fiber layer.

As the edema of the discs increased, it extended a greater distance out into the retina, especially into the macular area where small, irregularly round, white exudates were present (fig. 2). No definite stellate figure developed during the course of the disease.

The most interesting and striking features in the fundi were the vascular changes. The veins were mildly dilated and showed considerable irregularity in caliber. In a number of places they showed perivascular thickening. A shower of hemorrhages was seen along the distribution of several of the small venous branches, indicating the thrombotic nature of the vascular lesions. The spotty and disseminated distribution of the changes in the retinal arterioles was most interesting. In some areas the arterioles appeared

tations; cardiac hypertrophy. Multiple emboli in the brain stem with areas of focal necrosis involving the inferior portion of the pyramidal decussation. Multiple embolic pulmonary infarcts. Thrombosis of the right auricular appendages. Bilateral bronchopneumonia. Kidneys showed arteriosclerosis and multiple areas of focal glomerulonephritis. There was arteriosclerosis of the heart, spleen, and brain; atherosclerosis of the aorta. Marked central congestion of the liver. Lupus with involvement of the skin of the face and trunk. Right knee showed chronic synovitis.

Eye pathology. (Dr. Michael J. Hogan) *Gross examination.* The specimen consisted of the posterior half of the left eye which was removed at autopsy. Along some of the vessels, which showed white perivascular sheathing, were large, round retinal hemorrhages and a few dense, small round, white exudates. With the dissecting microscope, widespread patchy perivascular sheathing was visible.

Microscopic examination. Retina. Postmortem

changes were fairly marked in all layers, but especially so in the ganglion cell layer, nerve-fiber layer, and in the rod and cone processes. Some of the arterioles showed thrombi, without changes in the structure of the walls and these

exudates were found in the outer nuclear layer as well.

Surrounding most of the retinal vessels were fairly broad areas of degeneration (possibly postmortem). These degenerative areas were



Fig. 4 (Cordes and Aiken). (H&E high power) Retina, showing extensive deposition of the hyaline-like exudate in the outer retinal layers.



Fig. 5 (Cordes and Aiken). (Verhoeff stain, high power) Retina, showing proliferation of intimal connective tissue, narrowing of the lumen, and thrombosis of a retinal arteriole. Note the retinal exudates in the outer nuclear layer.

were probably embolic in origin (fig. 3). In many sections there were scattered, small, round hemorrhages in the nerve-fiber and internuclear layers, and numerous hyaline-like exudates in all layers of the retina (fig. 4). Near the disc, these

also found in the other layers, particularly the internuclear layer. In many sections, the retinal arterioles showed intimal thickening, with narrowing of the lumen (figs. 5 and 6). The smaller arterioles were also similarly affected and at

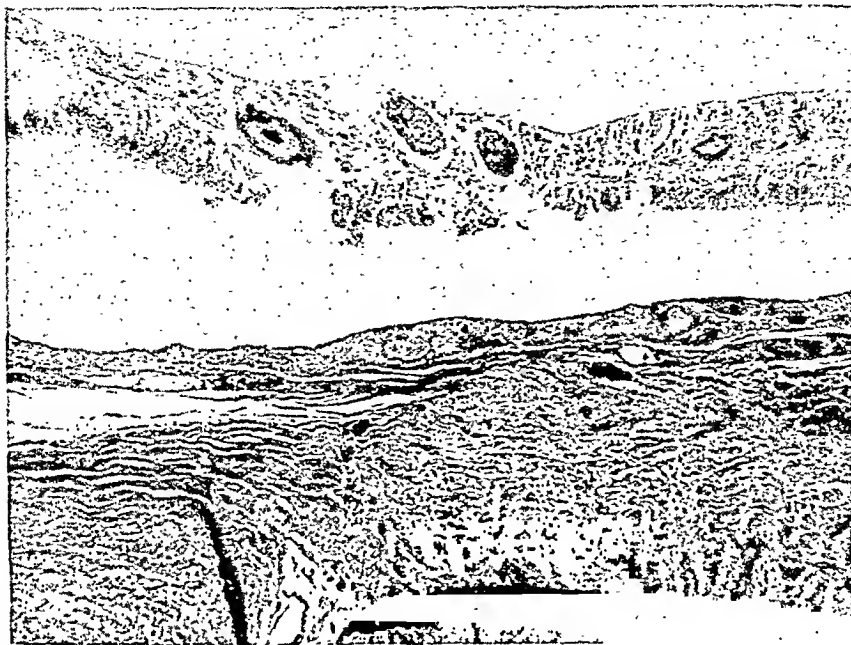


Fig. 6 (Cordes and Aiken). (H&E low power) The retinal vessels near the disc show marked intimal thickening, medial hypertrophy, and extreme narrowing of the lumina with thrombosis. Note the similar changes which have occurred in the small choroidal arteries.

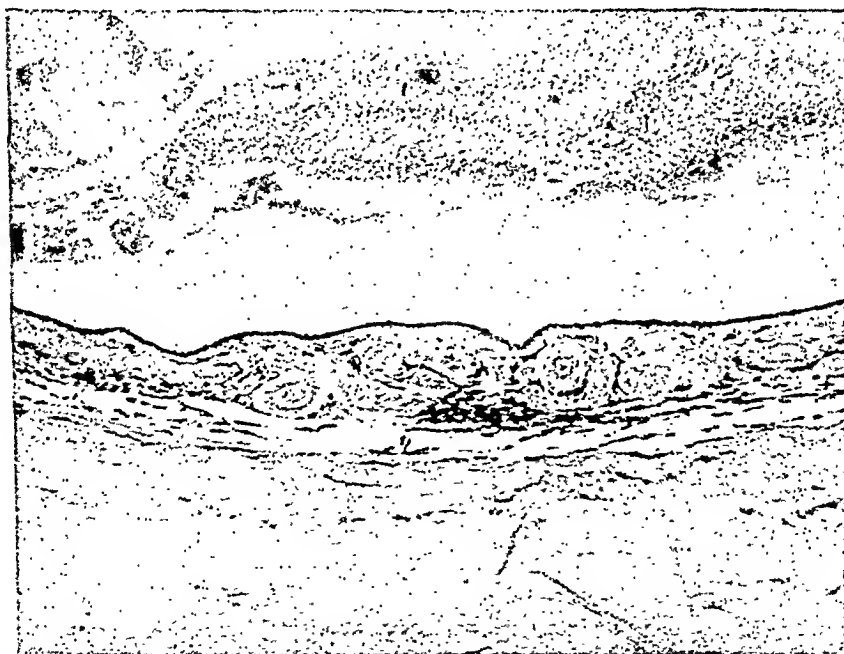


Fig. 7 (Cordes and Aiken). (Verhoeff stain, low power) Choroid. Note the marked narrowing of the lumina of the vessels due to intimal connective-tissue proliferation. One vessel is almost completely occluded.

times thrombosed. Other vessels showed sub-intimal thickening, with narrowing of the lumen. The veins did not seem to show much involvement. There was no inflammatory infiltration into the retina.

Choroid. The small arteries and arterioles of the choroid showed widespread changes, which were similar to those seen in the retinal arterioles (fig. 7). Some of these vessels showed marked subintimal thickening, and the lumina

were reduced the diameter of 1 or 2 red blood cells, or were completely occluded (figs. 8, 9, 10). Other small arteries contained thrombi without evident disease of the wall. Still others showed marked hyalinization of the walls, with

edema, with crowding of the retinal nuclear layers away from its edge. There was patchy atrophy, with demyelination of many nerve-fiber bundles. Surrounding, and posterior to the entrance of the central vessels into the nerve, the



Fig. 8 (Cordes and Aiken). (Verhoeff stain, high power) Choroid. Note the marked medial hypertrophy and intimal thickening. The lumen is considerably narrowed.

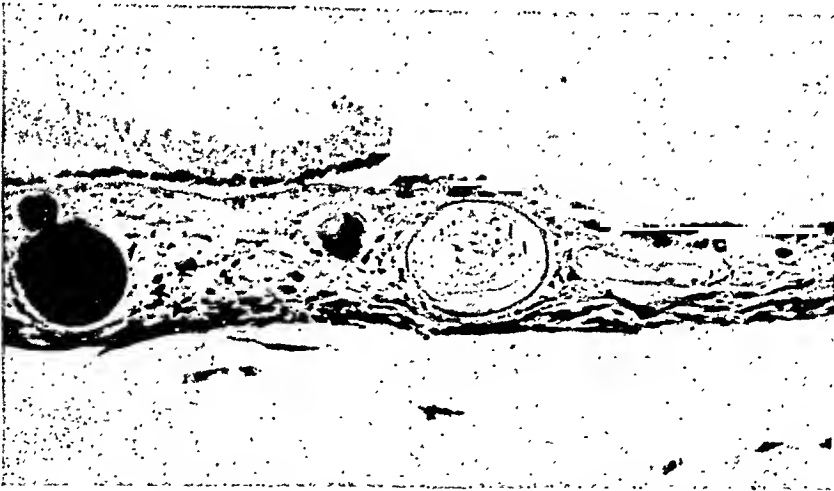


Fig. 9 (Cordes and Aiken). (Mallory connective-tissue stain, high power) Choroid. Complete occlusion of a choroidal artery due to formation of subendothelial connective tissue.

only moderate narrowing of the lumen (fig. 11). Occasional small choroidal hemorrhages were found, and there was slight diffuse round-cell infiltration. The choroidal veins, choriocapillaris and lumina were normal.

Optic nerve and disc. The disc showed marked

nerve showed marked degenerative changes, with necrosis, possibly due to occlusion of the posterior and nearby branches of the central retinal artery. This was thought to be so because the degenerated area was so sharply defined from the normal nerve tissue just a short distance



Fig. 10 (Cordes and Aiken). (Verhoeff stain, high power) Choroid. Marked intimal thickening and proliferation with obstruction of the lumen.

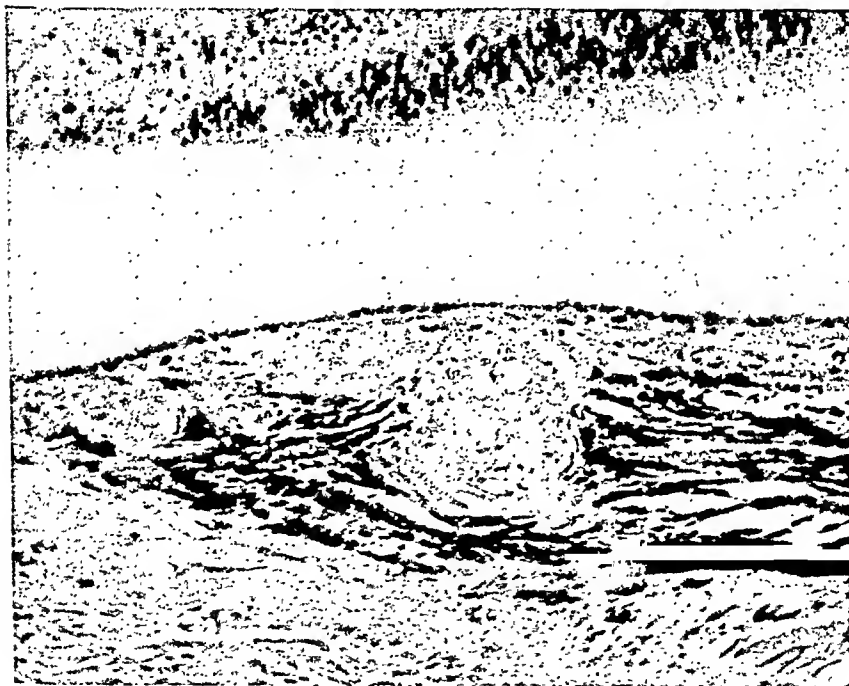


Fig. 11 (Cordes and Aiken). (High power) Choroid. There is hyalinization of the walls of the small choroidal arteries. The lumen is extremely small.

anterior to the entrance of the vessels. In this degenerated area many of the small vessels were occluded by thrombi, and had thickened walls. More anteriorly the central artery showed intimal thickening.

COMMENTS

From an analysis of the fundus findings in the literature and from our own observations, we are not inclined to re-

gard any single fundus lesion, or combination of fundus lesions, as being pathognomonic of lupus erythematosus. It is possible, however, to arrive at several general conclusions. When the disease becomes systemic, the initial fundus changes may be limited to dilatation of the retinal vessels. At this time, or soon thereafter, cotton-wool exudates and possibly hemorrhages may appear. This so-called "toxic retinitis" is probably the most typical and frequent fundus finding encountered in lupus erythematosus. This conclusion is consistent with the opinions of Wagener¹⁶ and others.

It is our belief that fundus changes beyond this stage are to be regarded as secondary to involvement of certain of the visceral organs, especially the kidneys and heart, and are due to widespread involvement of the arterial vascular system. This case did not come under our observation until 14 months after the onset of the disease. By that time the patient had already developed a hypertension and showed evidences of kidney damage and valvular heart disease. At this stage the retinal arterioles showed widespread organic changes in addition to cotton-wool exudates and hemorrhages, and it is not at all unlikely that these changes were nothing more than the manifestations of a diffuse hypertensive arteriosclerosis. Microscopic examination of the retina and the visceral organs tend to substantiate this conclusion. The vascular changes which were seen in this case, such as intimal thickening and sclerosis of the arteriolar and arterial walls, with narrowing and occlusion of their lumina, are characteristic of hypertension. Sections taken from the retina and visceral organs were sent to Dr. Henry P. Wagener of the Mayo Clinic, and he and Dr. J. W. Kernohan concurred in the opinion that the changes were characteristic of hypertensive-arteriolosclerosis. Dr. Kernohan

was unable to find any evidence of the type of vascular lesion presumed to be characteristic of the vessels in lupus erythematosus in the retina, the kidney, or any of the other tissues. He was especially interested in the thromboses, particularly in the retinal vessels, but stated he could not diagnose them as being of lupus origin since the typical intimal endothelial changes were absent. He further believed that the retinal and renal lesions represented a diffuse arteriolosclerosis complicating the lupus, rather than an actual lupus lesion of the vessels and kidneys with secondary hypertension.

It would seem, however, that the widespread vascular occlusive lesions would fit reasonably well into the picture of lupus. These may be embolic in nature, or due to thromboses occurring at the site of a toxically damaged endothelium. The patchiness of the vascular lesions observed clinically was confirmed pathologically. Some of the retinal arterioles appeared reasonably normal while others showed hyperplastic sclerosis, narrowing of the lumina and thromboses. This thrombotic and patchy nature of the vascular lesions is not inconsistent with lupus, although this point must be left open to question.

Wagener¹⁶ recently made the statement that "in view of the rather frequent occurrence of vegetative endocarditis in cases of acute disseminated lupus erythematosus, it is rather surprising that embolic phenomena are not observed more often in the retina." He reported such a case in which he observed an area of ischemic edema in one retina associated with closure, probably embolic, of a small terminal arteriole and, a few days before death, a number of petechial hemorrhages, with white centers, in each retina. The absence of petechial retinal hemorrhages in our patient is certainly surprising considering the fact that showers of

such hemorrhages were seen in the skin, and that at autopsy multiple emboli were observed in several of the organs, particularly the brain and lungs.

SUMMARY

A case of acute disseminated lupus erythematosus in a 30-year-old woman was observed clinically for a period of six months before fatal termination.

Fundus examination revealed cotton-wool exudates with small irregular hemorrhages as well as flame-shaped hemorrhages. There was edema of the disc. The most striking features were the vascular changes. The veins were dilated and irregular in caliber, with perivascular thickening and small isolated venous branch thromboses. The arterioles showed a spotty and disseminated distribution of markedly irregular localized narrowings. In some areas there was complete occlu-

sion, associated with perivascular thickening. There was also arteriolosclerosis.

Microscopic examination of the eye showed, in addition to the hemorrhage and exudates, subintimal thickening and sclerosis of the arteriolar and arterial walls with a narrowing of the lumina. There were scattered, widespread vascular occlusive lesions present. The vessels did not, however, show the intimal endothelial changes usually considered as characteristic of acute disseminated lupus erythematosus.

From a review of the literature and our own observations, we are not inclined to regard any single lesion or combination of lesions pathognomonic of lupus erythematosus. The so-called "toxic retinitis" is probably the most typical and frequent fundus picture seen in acute disseminated lupus erythematosus.

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CAPILLARY FRAGILITY AND CAPILLARY PERMEABILITY IN RELATION TO RETINAL HEMORRHAGE*

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The pathogenesis of retinal hemorrhage is frequently obscure. There is at least a possibility that certain of the cases may be due to an alteration in the capillary wall which may be present throughout the body, although obvious lesions may appear only in the retina. In an attempt to explore this possibility we have carried out certain tests, especially tests intended to demonstrate increase in capillary fragility and permeability in the cutaneous capillaries, in a series of patients suffering from retinal hemorrhage. Increase in capillary fragility would be expected to cause hemorrhage primarily in vessels of capillary type. The retinal capillaries would probably share in any capillary change occurring generally.

Since the drug rutin has been shown to improve capillary fragility when tested in the cutaneous capillaries,^{1,2} and also more recently³ to have a beneficial effect on increased capillary permeability, a clinical study of its effect on the recurrence of retinal hemorrhage was undertaken.

MATERIAL AND METHODS

Two separate groups of patients were studied. One group consisted of 47 subjects with recent retinal hemorrhage who were referred from other dispensaries of the University Hospital to a special dis-

pensary set up for this study. This group will be subsequently referred to as the dispensary group or dispensary series. Each patient was requested to visit the dispensary at least once every six weeks. In some cases visits were more frequent and in other cases, due to faulty patient coöperation, they were farther apart. However, 37 of this group returned for from 1 to 14 follow-up studies. All patients in this group were examined ophthalmoscopically on each visit by one of us (LaM.) with careful charting so that it seems reasonably certain that all ophthalmoscopically visible hemorrhages were detected.

The second group consisted of 32 patients with retinal hemorrhage referred as private patients to one of us (J.Q.G.). This group does not include all the patients referred to (J.Q.G.) because of retinal hemorrhage, but only those referred by nine ophthalmologists who, because of association with the authors or previous experience or interest in this study, might be expected to supply accurate data and coöperation in the follow-up study. Fifteen patients in this group were followed for a period up to four years, usually every 2 or 3 months so far as the studies (by J.Q.G.) are concerned. Eyegrounds were reexamined by the referring ophthalmologists but at more irregular intervals for this, the private group or private series, than for the dispensary group. In no case were these patients studied by the one (LaM.) who followed the eyegrounds of the dispensary group, nor in any case were the eyegrounds actually

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charted. Thus, for the private group, the occurrence of a small retinal hemorrhage, not apparent subjectively to the patient, nor noted by the ophthalmologist, nor absorbed before examination, cannot in every case be entirely excluded.

Blood pressure was measured routinely, and patients were questioned for known diabetes. Special studies included: (1) Measurement of capillary fragility based on the method of Göthlin³ but modified so that usually only the first stage was carried out. (2) Measurement of cutaneous lymphatic flow by the dye method of McMaster.⁴ (3) Measurement of plasma creatinine by the method of Steinitz and Turkand.⁵ (4) Determination of cutaneous capillary mobility by capillary microscopy.⁶ (5) In certain cases, bioassay for antidiuretic hormone of the pituitary gland.⁷

Studies 1 and 2 proved to be of considerable interest, and will be reported in detail. Studies 3, 4, and 5 proved to be relatively less important and will not be reported in detail, but simply considered in the discussion.

MEASUREMENT OF CAPILLARY FRAGILITY

1. A circular area, 6 cm. in diameter, is marked off in each antecubital space.

2. A blood-pressure cuff is placed about each upper arm and inflated to 35 mm. Hg for 15 minutes. Thereafter, petechiae are counted, using a good light and lens.

If 2, 1, or no petechiae appear, the fragility is considered normal; if 6 or more petechiae appear, the fragility is increased; if 3, 4, or 5 petechiae appear and the test is being carried out for the first time, fragility is borderline and a second stage, as described elsewhere,³ must be carried out; in a follow-up study, however, where the previous test was abnormal, 3, 4, or 5 petechiae are considered to indicate increased capillary fragility.

MEASUREMENTS OF CUTANEOUS LYMPHATIC FLOW

1. The blue colloidal dye, patent blue, is used, purified according to the method of McMaster.

2. About 0.04 cc. of the dye is injected intracutaneously, in the antecubital space, and the spread of streamers is followed for a period of 15 minutes. Spread during the first minute is due to the force of the injection, but thereafter spread depends upon the rate of lymph flow. If the spread from the 1st to the 15th minute is three-fourths of an inch or more, cutaneous lymphatic flow is increased; if less than three-fourths inch, flow is normal. The color disappears, always within two days, often in 18 hours. In some 5,000 tests, no reaction has occurred nor has any permanent discoloration resulted. Rarely, a transient redness is seen about the area of injection, lasting one hour.

The significance and importance of cutaneous lymphatic flow has been considered in more detail elsewhere,⁸ but it may be summarized here as follows: (a) Lymph is formed of fluid which has left the capillaries, and its rate of formation determines its speed of flow through the lymph vessels. (b) Increased rate of lymph flow can only result from increased passage of fluid through the capillary wall. (c) Increased passage of fluid through the capillary wall results when capillary pressure is increased without impediment to capillary flow, or where there is a primary increase in capillary permeability. In this sense, increased capillary pressure is thought to occur in association with fluid retention, in either renal or pituitary disease. If these conditions can be excluded, increased lymphatic flow may be presumed to be on the basis of increased capillary permeability, when it is frequently but not invariably associated with increased capillary fragility. This concept, however, as just described, has appeared

only about two years ago, so that lymphatic-flow studies are lacking in certain of the early cases of the private series.

PLAN FOR RUTIN MEDICATION

The nature and use of rutin has been described elsewhere.^{1, 2, 3} In general, the initial dose given was 60 mg. per day (20 mg. 3 times a day) and tests for capillary fragility and permeability, one or both depending on what findings were

subjects, capillary fragility was increased in 24 subjects but normal in 8; cutaneous lymphatic flow was increased in 8 subjects, normal in 15, and not done in 9; both tests were abnormal in 7 subjects and normal in 6 subjects.

Considering the two series as a whole, capillary fragility was increased in 47 of 79 subjects, or approximately 60 percent. Of the 70 subjects in whom cutaneous lymphatic flow was measured, it was

TABLE 1
RESULTS IN STUDIES OF CAPILLARY FRAGILITY AND CAPILLARY PERMEABILITY
IN RELATION TO RETINAL HEMORRHAGE

	Capillary Fragility			Lymphatic Flow			Both Tests	
	In-creased	Nor-mal	Total	In-creased	Nor-mal	Total	In-creased	Nor-mal
Dispensary group	23	24	47	25	22	47	12	11
Private group	24	8	32	8	15	23	7	6
Total	47	32	79	33	37	70	19	17

originally abnormal, were repeated in six weeks. The dose of rutin was increased so long as either test remained abnormal but was held constant when both tests were normal. The cases of the private series were studied every six weeks as long as either test was abnormal, and thereafter every three months, so far as possible. In general, patients in the dispensary group were seen every six weeks, regardless of the outcome of previous tests.

RESULTS

I. FINDINGS ON INITIAL EXAMINATION

1. *Capillary fragility and cutaneous lymphatic flow.* (See Table 1). In the dispensary group, consisting of 47 subjects, capillary fragility was increased in 23 subjects but normal in 24; cutaneous lymphatic flow was increased in 25 subjects but normal in 22; both tests were abnormal in 12 subjects and both tests were normal in 11 subjects.

In the private group, consisting of 32

found to be increased in 33 persons, or 47 percent. Putting it another way, in the 70 persons in whom both tests were carried out, only 17 subjects, or 24 percent, showed normal tests for both capillary fragility and cutaneous lymphatic flow.

2. *Sex incidence.* In the dispensary group, there were 19 males, and 28 females; in the private group 22 males and 10 females. Thus, in the combined groups there were 41 males and 38 females.

3. *Age incidence.* In the dispensary group the age range was from 29 to 72 years, but 85 percent of the patients were over 40 years of age, and 74 percent were aged 50 years or over. In the private group one patient was aged 22 years, 3 were between 31 and 40 years of age, 6 more were between 41 and 50 years, and the remainder, or 22 patients, were over 50 years of age, the oldest patient being aged 82 years.

4. *Incidence of diabetes.* In the dispensary group, 22 of the 47 patients were

diabetic, as were 5 of the 32 in the private group, making a total incidence of 27 out of 79 patients, or 34 percent.

5. *Incidence of hypertension.* In the dispensary group, 19 patients were hypertensive (systolic blood pressure 150 mm. Hg or more, or diastolic 100 mm. Hg or more, or both) and 15 of the private group, making an incidence of 34 out of 79 patients, or 42 percent.

6. *Incidence of diminished renal function as evidenced by elevation of plasma creatinine.* In the dispensary group 7 patients showed slight elevation of plasma creatinine, as did 4 of the private group, making an incidence of 11 out of 79 patients, or 14 percent.

II. RESULTS OF RUTIN THERAPY AND FOLLOW-UP STUDIES

1. *Period of follow-up study.* Patients in the dispensary group have been followed for 6 weeks to 13 months. Ten of the 47 patients failed to return, so only 37 are shown in Table 2. Only 15 of the private series have been followed, for a period of 6 to 51 months, averaging 13 months.

2. *Effect on capillary fragility.* Of the 37 patients followed in the dispensary group, 19 showed an initially increased capillary fragility. Of these, following rutin therapy with the dose and for the time interval as shown in Table 2, 9 showed fairly consistent return of test to normal, while in 10 fragility either remained consistently increased or was increased at times. It is not possible at this time to predict the result of increased rutin dosage or a longer interval of follow-up, especially as some of the patients are no longer under observation. Of the 15 patients followed in the private group, capillary fragility remained consistently increased in two and was intermittently increased in two, while in 11 it became normal.

3. *Effect on cutaneous lymphatic flow.* Of the 37 patients followed in the dispensary group, 22 showed an initially increased cutaneous lymphatic flow. Twelve of these showed a fairly consistent return to normal after rutin therapy, while in 10, lymphatic flow was either consistently increased or increased with sufficient frequency to make the course appear unsatisfactory. Again, one cannot predict the result of higher rutin dosage and a longer follow-up period. Of the 15 patients followed in the private group, 8 showed an initially increased cutaneous lymphatic flow. All of these have shown return to normal with one exception and that patient, a woman of 66 who has been followed for 15 months at approximately two-month intervals, had only one abnormal test in the series which preceded by three weeks her second and last retinal hemorrhage.

4. *Effect on recurrence of retinal hemorrhage.* In Table 2, each symbol means one study of a patient, 52 patients in all being charted. The symbol for the study made nearest the time of occurrence of a retinal hemorrhage is joined with either an h (dispensary) or H (private). In the column designated as "First Visit" all symbols are shown with either an h or H. Three patients, who had been given rutin prior to their referral to the dispensary, are listed in the "First Visit" column at their respective rutin dosages.

Six patients in the dispensary group that were followed had initially normal tests for both capillary fragility and cutaneous lymphatic flow, although three of these, at either the first or second follow-up showed one or both tests abnormal and in two instances this change occurred coincident with a fresh retinal hemorrhage. All three were then started on rutin. One patient, with initially normal studies, was seen once in follow-up, was normal at that time, and was not seen

TABLE 2
STUDY OF THE EFFECT OF RUTIN THERAPY

Rutin Dos- age mg. Per Day	First Visit	After Treatment Months						Years		
		0-2	2-4	4-6	6-8	8-10	10-12	1-2	2-3	3-4
None	hx = 1 ho = 3 hg = 10 HG = 11 hl = 12 HL = 1 hgl = 8 HGL = 3	gl = 1 o = 1 x = 1	hl = 1 ho = 1 l = 1		x = 1	x = 2 ho = 1	x = 2	x = 2 l = 1		
60	hgl = 1 ho = 1	hg = 2 HG = 1 o = 1 g = 4 l = 6 gl = 1 x = 6 X = 5	hg = 2 HG = 2 hl = 1 o = 1 g = 1 G = 1 l = 3 x = 6 X = 7	HG = 1 hl = 2 g = 1 L = 1 gl = 1 x = 3 X = 7	0 = 1 l = 2 x = 4 X = 7	o = 1 g = 1 x = 2 X = 4	o = 1 x = 1 x = 4	x = 1 x = 16	X = 6	X = 3
80	hx = 1	X = 1	hg = 1 O = 2	o = 2 X = 1	hl = 1 HL = 1 O = 1 X = 1	O = 1 X = 1	X = 2	X = 3	X = 3	X = 2
120		o = 1 g = 1 l = 4 gl = 1 x = 2	hg = 2 HG = 1 o = 3 g = 2 l = 1 x = 4	ho = 1 hg = 1 HG = 3 hl = 1 g = 2 l = 1 x = 4	hl = 1 o = 4 O = 2 g = 1 l = 1 x = 1	hl = 1 o = 1 O = 1 G = 1	ho = 1 HG = 1 hl = 1 o = 1 O = 2 l = 2	ho = 1 hg = 1 O = 2 g = 1 G = 1 X = 3	X = 1	
160						HO = 1 HG = 1		HG = 1		
180			hl = 1 g = 1 gl = 1	hl = 1 o = 2 g = 3 l = 1 x = 1	g = 3 l = 2 gl = 1 x = 1	o = 2 g = 2 l = 3	o = 2 g = 1	HG = 2 o = 2 g = 2 l = 1		
200			hg = 1 o = 1 g = 1	gl = 2	ho = 1 hg = 1 o = 1 l = 1	o = 1 g = 2	hg = 1			
240			l = 1	hg = 1 o = 3 g = 1	g = 2 gl = 1 x = 1	g = 1 gl = 1	HG = 1 o = 1			
280					hg = 1	l = 1	HG = 1 o = 1 g = 1			
400 and +						hg = 1	hg = 1 HG = 1 g = 1 G = 1 gl = 1			

since. The remaining two patients (of the six) were taking rutin at the time they were first seen in the dispensary. This was continued for a time. On subsequent follow-up one patient showed a fresh retinal hemorrhage, and both tests were abnormal. His dose of rutin was increased. The last patient was normal on follow-up, his rutin was discontinued, and he has remained well since and his tests have remained normal.

Thus, all but one of the patients charted in Table 2 took rutin at least at some time. Those indicated as not taking rutin after the sixth month represent cases that lapsed treatment, at least temporarily.

In the dispensary group, 18 of the 37 patients had at least one retinal hemorrhage during the follow-up period, and in five cases the hemorrhage was sufficient to affect vision and be subjectively noted, while in the remainder it was recognized only by ophthalmoscopic examination. In the private group, three of the patients had recurrent hemorrhage, all sufficient to affect vision.

Since several patients had more than one hemorrhage, it is apparent from Table 2 that a total of 51 retinal hemorrhages occurred in 21 persons during the period of observation. In these, there was

an associated increased capillary fragility 32 times, increased cutaneous lymphatic flow 12 times and, on seven occasions, hemorrhage occurred when both tests were normal. As Table 2 shows, hemorrhage occurred three times in persons not taking rutin, at least at the time preceding the hemorrhage.

5. *Rutin dosage.* As shown in Table 2, dosage ranged from 60 mg. per day to about 400 mg. per day, but 90 percent of the subjects studied were given 180 mg. per day or less. Three subjects who were followed longer than 2½ years were started on hesperidin (which does not appear in the table) but changed over to rutin about that time. Hesperidin has a chemical formula much like rutin, and was used by us originally. As a rule, the crude preparation of hesperidin acted like rutin, but the refined preparation was much less active and the crude preparation varied in potency. When rutin, a chemically pure substance which was uniformly active, became available, it was substituted in all cases for hesperidin.

DISCUSSION OF RESULTS

The incidence of elevated plasma creatinine, hypertension, diminished capillary mobility (9 cases), and positive bioas-

EXPLANATION: Each symbol appearing alone or in combination with another symbol, represents one period of study.

g, G indicates increased capillary fragility.

l, L indicates increased capillary permeability (increased cutaneous lymphatic flow).

x, X indicates a period of study in a patient whose general course is favorable in that retinal hemorrhage has not recurred and that capillary fragility and permeability are normal with fair consistency.

o, O indicates a period of study in a patient whose general course is unfavorable in that, while tests for capillary fragility and permeability are normal at the time of that study, they are either not normal consistently or, some time during the course of the study, a retinal hemorrhage has occurred.

h, H in combination with any other symbol means that a retinal hemorrhage has occurred near the time of the study.

g, l, x, o, h indicate patients of the dispensary group.

G, L, X, O, H indicate patients of the private group.

It should be noted that a patient represented by x or X is always represented by the same symbol, whereas unsatisfactory cases may be represented, depending on the findings, by g, l, o, h or G, L, O, H. By definition of a satisfactory case, h or H cannot appear combined with x or X, after treatment has been begun. The number associated with a symbol or symbol group indicates the total similar tests for that period, but this cannot always be translated into total number of patients since, especially for the longer periods, the same patient may appear more than once.

say for antidiuretic hormone (8 cases) did not significantly influence the results of therapy, and have not been reported in detail. Some difference might appear, however, in a larger series, and it is a clinical impression that the occurrence of any of these factors makes chance for success with therapy a little less likely. The same can be said for diabetes, although here the evidence is suggestive, but not absolutely significant.

It is quite apparent, however, that there is no relation between the degree of elevation of systolic and diastolic blood pressure, in subjects with hypertension, and the incidence of retinal hemorrhage.

The relation of increased capillary fragility and increased cutaneous lymphatic flow with retinal hemorrhage is significant, both in the initial hemorrhage and in recurrence, although it is obvious that a direct relationship seems to exist for only a certain group of the cases. There are undoubtedly cases where retinal hemorrhage occurs entirely apart from any change in general capillary fragility and permeability.

However, the role of rutin in correcting this capillary condition and, perhaps, thereby avoiding further hemorrhage is less clear. Rutin has been less effective in correcting increased capillary fragility and permeability in the present series than in the series of hypertensives previously reported,³ and the dosage required has frequently been larger. Moreover, certain patients have had recurrence of retinal hemorrhage even while tests for capillary fragility and permeability have been normal, so that one must conclude that additional factors are present in these cases or, perhaps, the initial hemorrhage has somehow predisposed to recurrence. Also, it should be noted that results appear to be better in the private than in the dispensary group, which may be due to difference in economic status,

or difference in sex predominance (more males in the private group, more females in the dispensary group), or simply a difference in completeness of ophthalmoscopic charting in which case the difference would be apparent rather than real. Unfortunately, it has not been practicable to study an untreated group, but it seems probable, but not absolutely certain, that rutin in some cases has been useful in preventing further retinal hemorrhages.

SUMMARY AND CONCLUSIONS

1. A considerable number of patients with retinal hemorrhage have an associated generalized capillary abnormality, as shown by abnormal response to tests for capillary fragility and permeability carried out on the vessels of the skin. The present series showed about 75 percent of such incidence for either one or both tests, and this is considered significant since these tests are uniformly negative in perfectly normal individuals.

2. Recurrent retinal hemorrhage, occurring during the period of study, was usually but not invariably associated with either increased capillary fragility or permeability, as shown by the tests.

3. In the series studied, rutin therapy was followed by return of tests to normal in about half of the dispensary group and in about 70 percent of the private group and such subjects usually, but not invariably, failed to develop further retinal hemorrhage. Considering the number of cases, the period of follow-up, and the scatter of results, final conclusions cannot be drawn, but it is at least suggestive that rutin, in adequate dosage and given over a long enough period, may be of value in preventing further retinal hemorrhage in that group of patients where the initial hemorrhage was associated with a generalized capillary fault.

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THE EFFECT OF VISUAL TRAINING ON EXISTING MYOPIA*

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This research was undertaken in an effort to determine the value of visual training as a means of improving the visual acuity in patients with myopia. During the past few years, ophthalmologists have often been questioned by the parents of myopic children and by myopic individuals relative to the possibility of improving their sight, or of overcoming their near-sightedness, so that they might no longer have to wear glasses to see well at a distance. These queries have become so frequent that it seemed incumbent upon ophthalmologists to try to evaluate such methods of training as are employed by many optometrists and a few ophthalmologists.

The first efforts to improve vision by means other than glasses that received wide public attention were those advocated by the late W. H. Bates, M.D., who caught the public notice by means of a book entitled *Perfect Sight Without Glasses*, published in 1920. This idea, so fascinating to the wearers of glasses and especially to those who were forced to use strong corrections, naturally had great appeal and his training program developed a considerable following. The fact that very few have been able to dispense with their glasses is sufficient evidence of the ineffectiveness of the method. The idea, however, was so attractive that it was seized upon and efforts made to find more satisfactory methods than the Bates training for accomplishing the same purpose.

Many different training techniques have been studied and are employed. Most of them, however, have a common background of thought that has been standardized to a considerable degree in some of

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the optometric schools of the United States. Variations in details are, of course, practiced by almost everyone who gives this type of training. For the purpose of this study a method that closely approaches the most frequently employed ideas was used and will be given in detail later in this article. Longer or shorter periods of training might have produced different results. Two of the most outstanding cases of improvement observed during this time were not treated in this group, but by a practitioner not engaged in this particular project.

Although visual training for myopia had been in use for a number of years by optometrists at the time of the inception of this program, there was no report found in the American ophthalmic literature of a series of cases of myopia in which such training had been done with careful ophthalmologic examinations. It is interesting that coincidental with our study a somewhat similar one was being carried out in Baltimore. A series of 103 patients has been reported by Alan Woods, M.D., in the *American Journal of Ophthalmology* for January, 1946. Their work differed in that the entire training program was controlled by an independent group of optometrists whose detailed technique was not reported, although ophthalmologists of the Wilmer Institute examined the cases before and after training.

EXPERIMENTAL PROCEDURE

There are obviously innumerable phases to the problem of exercises in myopia, so it seemed best to attempt only a small part of the study in order that one phase at least could be comprehensively investigated; hence, the limitation to the study of the possibility of improving vision of myopic patients by training. Other pertinent questions are: How long does improvement, if any, continue? In what types of myopia is the training most effective?

Does the treatment have any effect on the rate of increase in progressive myopia? What would be the effect on other refractive states, as hyperopia, astigmatism, an anisometropia? What is the mechanism by which improvement, if any, is brought about?

As the primary objective of the problem as outlined was the determination of the possibility of improvement of the visual acuity in the myopic patient, it was evident that the group of patients should be standardized as much as possible, eliminating variables and unfavorable conditions so as to obtain the maximum improvement in the myopic factor. Because of this, the following standards were decided on: (1) Age 10 to 30 years. (2) Range of myopia in the greatest meridian: $-0.50D.$ sph. to $-3.00D.$ sph. (3) Astigmatism of 1 diopter or less. (4) No anisometropia of more than 1 diopter. (5) Correctible visual acuity of at least 20/20 in each eye. (6) No abnormal heterophoria, fusional defects, or substandard accommodation. (7) No internal or external organic condition.

The actual investigation resolved itself into the following steps: (1) The preliminary ophthalmologic examination. (2) The optometric survey. (3) The actual visual training. (4) The final ophthalmologic survey. (5) The analysis of the results. (6) The interpretation of the results with any possible conclusions.

In order to study the subject as intelligently as possible, it seemed wise to utilize the services of optometrists who were giving this type of training and of ophthalmologists who had not used these methods. Accordingly a team was formed for this study composed of ophthalmologists, optometrists, and opticians. The following arrangement of the team was decided upon: For the actual training, J. R. Bockhorst, O.D.; for the preliminary and final ophthalmologic surveys, H. Rommel Hildreth, M.D., William H. Meinberg,

M.D., Benjamin Milder, M.D., and T. E. Sanders, M.D.; and as a consulting group, E. C. Ebeling, O.D., Lawrence T. Post, M.D., and J. L. Stevenson. A full-time technician, Mrs. Harriet Thursby, did the majority of the actual training under the direct supervision of an optometrist.

OPHTHALMOLOGIC EXAMINATION

The ophthalmologic examination was divided among several individuals, the conditions and the examiner remaining constant for all patients examined. On the first visit (T. E. S.) a short history was taken including familial tendencies toward myopia, the length of time that myopic correction had been worn, the date of the last change, and the frequency of change of correction as related to progression. A general external and ophthalmoscopic examination was then made. Finally, the uncorrected visual acuity at 20 feet was determined with a Snellen letter chart. If the vision was less than 20/100, a shorter distance with the 20/100 letters was used. It was thought that this line would be more accurate than the 20/200 letter when used as a "walk-up," as it interpolates between 20/100 and 20/200.

Obviously the accurate determination of the visual acuity is the essential of the whole program. Theoretically a chart that is variable with similar and unfamiliar characters, as the Landolt broken ring, is much more desirable as it eliminates memory and past experience. At the beginning of the series the Landolt ring was used along with the ordinary Snellen chart with constant illumination. Three different Snellen charts were used interchangeably to eliminate memory. It was found early that lack of correlation between the Landolt and the Snellen charts was so great that it was difficult to interpret the results satisfactorily. The results with the Snellen chart alone were consistent and satisfactory. These find-

ings were also consistent with those of the optometrist using a Projecto-Chart. On the first visit the optometric examination (J. R. B.) was also done, as it was considered necessary to do this before a cycloplegic was used. This procedure is given in detail later.

On the next visit (H. R. H.) homatropine (2 percent) was instilled at 10-minute intervals for five times. Following this, a retinoscopy and a static refraction were done. The residual accommodation was then measured. At the third visit (B. M. and W. R. M.) a postcycloplegic refraction was done and the ocular muscle balance examined, which included: (1) The near point of accommodation as measured with Prince's rule; (2) the near point of convergence; (3) the degree of fusion as found on the synoptophore; (4) the lateral and vertical muscle balance at 20 feet and 16 inches as determined with prism dissociation; and (5) the lateral and vertical fusional amplitudes as determined with rotary prisms.

Following this preliminary examination, the patient was then referred for visual training (J. R. B.) as outlined hereafter.

After completion of the visual training the above ophthalmologic examinations were repeated exactly. At this time the individual patients were questioned as to their ideas of the value of the training and their opinion as to any subjective improvement in vision.

OPTOMETRIC EXAMINATION ROUTINE

The optometrist giving the training submitted a very detailed report on the examination routine and training technique he used throughout the program. This is available in the files of the Oscar Johnson Institute for those desiring to refer to it. A brief outline of this routine is as follows:

Steps 1 and 2. Visual acuity at 20 feet without correction and with habitually worn glasses.

Steps 3 and 4. Near vision with and without glasses.

Step 5. Measurement of interpupillary distance.

Step 6. Ophthalmoscopic examination.

Step 7. Ophthalmometric measurements.

Steps 8 and 9. Phoria test at 20 feet and 16 inches with habitually worn glasses. A 6-degree prism was placed base up and the horizontal phoria measured by the Risley rotary prism.

Step 10. Static retinoscopy at 20 feet.

Step 11. Dynamic retinoscopy at 20 inches.

Step 12. Dynamic retinoscopy at 40 inches.

Step 13. Subjective refraction test at 20 feet.

Step 14. Horizontal phoria at 20 feet with correction found in Step 13.

Steps 15 and 16. Adduction and convergence at 20 feet.

Step 17. Abduction at 20 feet.

Step 18. Vertical phoria test at 20 feet.

Step 19. Horizontal phoria at 16 inches with correction found in Step 13.

Steps 20, 21, 22, and 23. Listed as monocular and binocular cross-cylinder tests at 16 inches. A cross-cylinder was placed before each eye and a gridlike target observed. Spherical lenses were changed until the vertical and horizontal lines on the grid appeared alike.

Steps 24 and 25. Positive and negative fusional reserve relative convergence at 16 inches.

Step 26. Vertical phoria at 16 inches.

Step 27. Amplitude of accommodation.

Steps 28 and 29. Positive and negative relative accommodative reserve.

The detailed report ends with the sentence, "The 29th step completes the tests used and provides the basis for diagnosis of the subject's functional visual problem."

TECHNIQUE OF VISUAL TRAINING

The procedure outlined here required the use of an Arneson Squint Corrector, a Keystone Tel-Eye Trainer with certain Keystone cards whose numbers are given later, and an American Optical Company Wells-Head. The technique was broken into 11 individual steps laid out for a training period of 24 days averaging about one hour per day.

First Sequence, Six Days of Training

Step 1. Subject was seated before the Arneson Squint Corrector approximately 20 inches from the instrument. The in-

strument was equipped with a large disc with a medium-sized fixation target that could be rotated clockwise and counterclockwise. The right eye was occluded with a patch. The instrument was started rotating clockwise with instructions to the subject to fixate constantly the medium-sized target as it moved in a circular fashion. While fixating the target, his attention was also directed to the referential background of the disc which consisted of a black, red, and blue "E." The disc was rotated for three minutes. After the three-minute period the instrument was reversed to a counterclockwise direction, the whole procedure being repeated for three minutes. The same procedure was repeated occluding the left eye. Total working time for each eye was six minutes.

Step 2. Subject was placed before the Tel-Eye Trainer. The instrument was set at infinity position on the graduated slide, using Rotor 4 giving a four-second flash. No lenses were used. Two sets of cards were used, different sets on alternate days. The sight of the right eye was blanked out by manual push-button control and the left eye only was permitted to view the card, BO1-EC1. There were numbers interspersed throughout the field of the picture and the subject was instructed to locate the numbers in sequence from 1 to 10. If the picture or numbers appeared blurred, no changes or alterations were made in the setting of the instrument. The subject was instructed to keep watching the card until the numbers began to clear. This training was continued for five minutes. For training of the right eye the instrument setting remained the same with the exception that the left eye was now blanked out and Card BO1-EC3 inserted. This card was the same as the first with the exception that the numbers were in different positions throughout the field. On alternate

days Cards AN18 and AN16 were used in the same manner. Instructions in procedure remained the same. Step 2 was all monocular training.

Step 3. Subject remained at the Tel-Eye Trainer. No lenses were used. Slide remained at infinity and Rotor 4 was used. Both eyes were uncovered and for five minutes the Card BU5 was used with the subject seeing a picture of a room with the right eye in black and white, the left eye viewing a solid red field with numbers scattered through the field from 1 to 7. Instructions were to fuse the two unlike backgrounds into a single picture with the subject locating the black numbers and attempting to maintain clearness. When blur was reported, the setting of the instrument remained the same with emphasis placed on the subject's concentration to clear the numbers in spite of blur. Card BU5 was removed and Card BU6 inserted. The subject now viewed the black and white background picture in front of the left eye with a solid red field in front of the right eye, with numbers interspersed in the background from 1 to 8. The same instructions were given to the subject in viewing this card as in Card BU5. The procedure covered five minutes. Step 3 was monocular training in binocularity. Total training time for Step 3 was 10 minutes.

Step 4. Subject remained at the Tel-Eye Trainer. The instrument was set to flash alternately using Rotor 3 (3-second flash). Cards BO1-EC2 and BO1-EC4 were used. These cards were the same as the cards noted in the second step with the exception that the numbers were scattered in new positions. Instructions to the subject were to clear the numbers and the picture alternately with each eye. The second series of cards used in Step 4 were the AN1 and AN3. The cards of series one and two were used on alternate days. The AN1 card was a yellow

background card with numbers arranged in a circle and a star figure in the center connecting the numbers. When the alternating flash was started, the subject located the number 1 with the right eye, the number 2 with the left eye, number 3 with the right eye, number 4 with the left eye, and so forth, until he had gone through 12 numbers. Procedure was repeated for five minutes. The AN3 card was a similar card with these exceptions; the background of the card was now white with considerably smaller numbers. In addition to locating the numbers alternately, the patient was instructed to see the numbers clearly. Step 4 was an alternating monocular training procedure.

The above four steps were repeated for six days. Beginning the seventh day Step 5 was started, all of the previous steps being discontinued.

Second Sequence, Six Days of Training

Step 5. Subject was placed before the Arneson Squint Corrector, disc approximately 20 inches from the subject. A vertical dissociating prism, 6 degrees base up, was placed before the right eye. A vertical displacing prism, 4 degrees base down, was placed before the left eye. The subject was instructed to see two targets constantly. The instrument was turned on, rotating clockwise, with instructions to concentrate attention on the top target for 10 to 15 turns, always being aware of the lower target. Attention was then directed to the lower target as the fixating target for 10 to 15 turns with instructions to the subject always to be aware of the upper target. The procedure was followed for five minutes. The change in the prism setting was as follows: a 4-degree prism, base down, was now placed before the right eyes and a 6-degree prism, base up, was placed before the left eye with the same instructions followed for five minutes in the viewing of the two targets.

Step 5 was a rotation exercise, monocularly, in binocularity.

Step 6. Subject was placed before the Tel-Eye Trainer. The instrument was set at infinity on the slide, using Rotor 2 (2-second flash). Both eyes were uncovered. Cards BU8 and BU7 were used in the slide holder. When viewing Card BU8, the subject had a black and white picture in front of the left eye and a red and blue background in front of the right eye with numbers scattered throughout the red and blue field from 1 to 8. The color arrangement of the picture in front of the right eye was that the top half was red, the lower half blue. When the light flashed on, the black and white picture and the red and blue backgrounds had to be fused into one. The numbers scattered in the red and blue fields had to be clear. Procedure was followed for five minutes. Then Card BU7 was inserted into the instrument, which card was exactly reversed as compared to Card BU8. The black and white picture appeared in front of the right eye, the red and blue background appeared in front of the left eye. Numbers ranged from 1 to 9 in the colored field. The same instructions to clear numbers were given for this card. Procedure was followed for five minutes. Step 6 was monocular training in binocularity.

Step 7. Subject remained before the Tel-Eye Trainer instrument. Slide remained set at infinity, using Rotor 8 which gave alternate flash followed by binocular flash. Cards placed in the instrument card holder were ST2, Series I. This series consisted of three cards that produced stereoscopic vision and had control marks located in this sequence: Control marks on Card 1 were set toward the left side; control marks on Card 2 were located centrally; and control marks on Card 3 were located to the right. The subject was instructed to see the pictures

clearly and to fuse the control marks into a perfect cross. Each card was left before the subject for a period of five minutes. On alternate days ST2, Series II, were used with the same instructions to the patient as covered in the Series I. Step 7 was training in stereoscopic development and binocular control.

Step 8. Subject remained seated before the Tel-Eye Trainer. Slide holder was moved into the 2.50 position. Light flash, using Rotor 7, was set to operate simultaneously before both eyes. Cards SST2 were placed in the card holder. The series used were the cards numbered 0115, 0118, and 0113. Each card was viewed for five minutes. Subject's instructions were to fuse the cards into a single clear picture with emphasis being placed on his ability to produce a perfect cross of the control marks which appeared first to the left, next to the center, and lastly to the right. Step 8 was training in near-point stereopsis and binocular control.

Third Sequence, 12 Days of Training

Step 9. After Steps 5, 6, 7, and 8 had been repeated for six days, a reexamination was made after which the third phase of the visual training was instituted. Step 9 was the repetition of Step 7.

Step 10. Repetition of Step 8.

Step 11. Part I. Subject was placed before the Wells-Head. Steady light was used. Cards were placed at four inches and an auxiliary pair of plus-10 lenses was put in the instrument. Rotary prisms were placed before the subject's eyes. This setting produced a stereoscopic effect. At the zero markings, the subject looked at Card E2 with instructions to see the object with clearness and a sense of depth. The subject received frequent rest periods by closing eyes for approximately five seconds at a time. The rotary prisms were turned base out two degrees at a time with the caution to the subject that

the card must remain clear and single. The strength of the rotary prisms was constantly increased in these 2-degree, base-out jumps until the subject could maintain single and clear vision through a total of 32 degrees, base out, 16 degrees over each eye. Training on this card was performed for five minutes. For five minutes Card C4 was placed before the patient. Rotary prisms were started at 0, again increased two degrees base out at a time until a total of 32 degrees prism base out was reached, 16 degrees over each eye, with the same instructions that the object must appear clear and single. Card 6CM was then inserted. Rotaries were placed at 0 and increased in 2-degree steps until a total of 32 degrees prism base out, 16 degrees over each eye, had been reached with the same instructions to the patient that the target must be clear and single. Total training time was 15 minutes.

Step 11, Part II. Subject was placed before the Wells-Head. A 6-degree prism, base in, was placed in the instrument. The target viewed first was a type approximately Jaeger 3. The target was set at the 16-inch mark on the reading rod. The instructions to the subject were that the print must remain clear and single at all times. Then plus lenses were introduced in $\frac{1}{4}$ -diopter steps with the instruction to the subject, as the lens was changed, that again the print must remain clear and single. At the first increase of plus in the $\frac{1}{4}$ -diopter steps that produced a very slight blur, the subject was told to attempt to sharpen the print. When it became impossible for the subject to improve vision with increase in plus, the 6-degree prism, base in, in the rotaries was reduced two degrees at a time until the prisms were back to 0. At this time alternate size types of print were used varying between the original Jaeger 3 down to Jaeger 1.

The above steps, 9, 10, and 11, were continued for 12 visits. Again the subject was examined. Only those patients that appeared to have the ability to accomplish any further results in the above handling were permitted to repeat for an additional 12 visits.

Steps 9, 10, and Part I of 11 were used in those cases that appeared to be a basic problem of faulty convergence ability.

Steps 9, 10, and Part II of 11 were used in those cases that appeared to be a basic problem of faulty accommodative faculty.

RESULTS

This study represents a series of 87 patients examined, but a number of others were refused because of obvious defects. Thirty-three cases were either rejected or incomplete so that 54 case records were available for study. The majority of these patients were obtained by referral from the private practices of a number of St. Louis ophthalmologists, but some were referred by interested local optometrists. The series was not larger because of the strict limitations listed above.

As expected, no change was noted in the external or ophthalmoscopic examination of any patient. In no case was there any significant difference in the cycloplegic refractions done before and after the period of visual training. There was no more than one diopter of residual accommodation under cycloplegia remaining in any instance.

There was no appreciable effect of the visual training on the near point of convergence, near point of accommodation, or the fusional ability. About 50 percent of the cases showed an increase in esophoria of at least five prism diopters, or a decrease in the exophoria of about the same amount. In almost one half of the cases there was an increase of at least 10 prism diopters in adduction (positive fusional amplitude). There was no apparent

TABLE 1
PRE- AND POSTTRAINING VISUAL ACUITY, THE PATIENTS BEING REPRESENTED BY THEIR SPHERICAL EQUIVALENT

	5/100	10/100	12/100	15/100	20/100	20/70	20/50	20/40	20/30	20/25	20/20	Total
5/100		-2.50										1
10/100		-3.00 -2.75 (3)		-2.50 -3.00								6
12/100					-2.25		-2.50					2
15/100				-2.50 -2.75	-1.75	-2.25						4
20/100					-3.00 -2.75 -2.50 -2.00 -1.75 (2)	-3.00	-2.50					8
20/70						-3.00 -2.25 (2) -2.00 -1.75 (2) -1.50 (3)	-2.25	-2.00 -1.50 -1.25 -1.00				14
20/50							-2.25 -2.00 -1.50 -1.25	-0.75	-1.25			6
20/40								-1.25 (3) -1.00 -0.75	-1.50 -1.25 (2) -0.50	-1.00 -0.75		11
20/30											-0.75 -0.50	2
20/20												0
Total	0	5	0	4	8	11	7	10	5	2	2	54

TABLE 2
DISTRIBUTION OF ALL CASES

	Group 1 Myopia -1.00 sph. and under	Group 2 Myopia -1.25 sph. to -2.00 sph.	Group 3 Myopia -2.25 sph. to -3.00 sph.	Total
No Change	2 cases 22% of Group 1	15 cases 65.2% of Group 2	13 cases 54% of Group 3	30 cases 55% of all cases
Questionable Change	2 cases 22% of Group 1	4 cases 17.4% of Group 2	6 cases 27.2% of Group 3	12 cases 22.2% of all cases
Improvement	5 cases 55% of Group 1 Average Change—12.1%	4 cases 17.4% of Group 2 Average Change—18.7%	3 cases 13.6% of Group 3 Average Change—35.7%	12 cases 22.2% of all cases Average Change—27.1%
Total	9 cases 16.6% of all cases	23 cases 42.6% of all cases	22 cases 40.7% of all cases	54 cases 100%

relationship between the amount of the myopia and the effect of the visual training on the muscle balance. There seemed to be no relationship between the induced changes in the muscle balance and the final visual result.

As our patients had no, or only small amounts of, astigmatism and of anisometropia, the refractive error of the fellow eyes of all of our patients were quite similar. Because of this, the average spherical equivalent of each patient based on his homatropine refraction could easily be determined. On this basis we were able to divide our patients into three groups: Group 1, those patients with average myopic errors of one diopter or less; Group 2, those patients with average myopia from -1.25 sphere to -2.00 sphere; and Group 3, those with average errors from -2.25 sphere to -3.00 sphere. It was also noticed that rather than try to analyze changes in the vision of separate "eyes," it was much more satisfactory to tabulate the binocular vision, particularly as this is the actual useful vision of the patient. Table 1 shows the pre- and post-training acuities of all the 54 patients, each patient being represented by his spherical equivalent.

The problem of how to evaluate an actual change in visual acuity on an accurate quantitative basis is extremely difficult. The simplest method is merely the number of lines improvement as measured on the ordinary Snellen chart. This presupposes that the difference between each line is the same, which is obviously untrue. Another method, which Woods used in evaluating his results, determines any improvement in terms of percentage points. This is done by determining the difference in the percentages of visual efficiency of the pre- and posttraining visions, using the tables developed in industrial ophthalmology for evaluation of losses in visual efficiency following in-

jury. As Woods points out, this weighs the results in favor of the higher degrees of myopia, in as much as a case with improvement from 20/200 to 20/100, or one line, shows an increase of 28 percentage points in contrast to a case with improvement from 20/50 to 20/20, four lines, which totals 22 percentage points. Obviously, this is not valid either clinically or statistically.

After studying our cases, it was evident that the easiest method was a simple qualitative one. Thirty patients, or 55.5 percent, showed no change in the visual acuity following the course of visual training. No patient had a reduction in vision. Twelve patients, or 22.2 percent, showed a questionable improvement which consisted of a change of one line or less in acuity. It was thought that this improvement was meaningless as it was within the limits of error. This is especially true since the patients during the period of training did not wear their ordinary corrections, thus giving them experience in the judgment of blurred images. Twelve, or 22.2 per cent, of the patients showed definite improvement of vision. These results in relation to the three separate groups are shown in Table 2. Using the visual efficiency table given in Snell's *A Treatise on Medicolegal Ophthalmology*, the improvement in percentage of visual acuity was found to average 27 percent in the favorable cases.

Group 3, those with an average myopia of -2.25 sphere to -3.00 sphere, consisted of 22 patients. Of these only three, or 13.6 percent, showed any appreciable improvement. There were six with some change and 13 with no change. The three cases representing improvement changed from 15/100 to 20/70, 20/100 to 20/50, and 12/100 to 20/50. This represents an average improvement of 35.7 percentage points.

Group 2, consisting of patients with

average myopia from -1.25 sphere to -2.00 sphere, included 23 cases. No change was noted in 15 cases and questionable changes in four. Four, or 17.4 percent, showed real improvement averaging 18.7 percentage points. These included three with change from 20/70 to 20/40, and one with improvement from 20/50 to 20/30.

Group 1 consists of nine patients with a myopic error of one diopter or less. Two each showed no change and questionable improvement. Five, or 55 percent, of these patients with small errors showed definite improvement with an average improvement of only 12.1 percentage points. Two of these patients showed improvement from 20/30 to 20/20, these being the only ones with improvement to 20/20. Two showed change from 20/40 to 20/25 and one 20/70 to 20/40.

A late recheck of the visual acuity was possible in 11 of the 12 cases showing improvement, the interval between the posttraining acuity and the final acuity ranging from 15 months to 23 months. These results are found in Table 3. It will be noted that five (Nos. 2, 3, 4, 5, and 10) retained all of their improvement, while three (Nos. 1, 6, and 7) reverted to their pretraining acuity. Two (Nos. 8 and 11) retained a slight improvement, while only one (No. 9) lost vision over the pretraining acuity.

CONCLUSIONS

In the first place, we realized before undertaking this problem that, no matter what our results, they would probably be criticized by both proponents and opponents of this controversial subject. If our percentage of improvement was not high enough to please the proponents, it would be charged that our technique of training was inadequate, omitting a critical or essential step. On the other hand, those who doubt that visual acuity can be altered by

such training will say that the methods of taking the vision were at fault and that removing a person's glasses will improve his unaided vision within a period of weeks without training.

Although different techniques or a larger and more varied series of cases might alter our exact figures, we believe that study of these results shows that vision in certain myopic individuals can be improved by training. Even if we

group in each series is 27 percent.

As might be expected, the best results occurred in the cases of low myopia of one diopter and under (55 percent improvement). There is less defect to be overcome in these cases and the better initial vision would probably make training easier. Although the series is not large enough to give accurate figures, the results of Group 2 (17.4 percent improvement) and of Group 3 (13.6 percent

TABLE 3
LATE VISUAL ACUITIES

Group	Patient	Spherical Equiva- lent	Pre- training Acuity	Post- training Acuity	Interval Months	Final Acuity	Result
Group 1	1	-0.75	20/30+3	20/20-4	15	20/25-2	Unchanged
	2	-0.50	20/30	20/20	16	20/20-3	Retained Improvement
	3	-0.75	20/40-2	20/25-3	16	20/25-3	Retained Improvement
	4	-1.00	20/40+1	20/25-1	19	20/20-3	Retained Improvement
	5	-1.00	20/70	20/40-3	15	20/40+3	Retained Improvement
Group 2	6	-1.25	20/50+2	20/30+3	16	20/40-2	Unchanged
	7	-1.50	20/70+1	20/40+1	17	20/70+	Unchanged
	8	-2.00	20/70	20/40+3	16	20/50+3	Partially Improved
Group 3	9	-2.25	15/100	20/70-1	23	10/100	Worse
	10	-2.50	12/100	20/50-1	22	20/50+2	Retained Improvement
	11	-2.50	20/100	20/50-3	18	20/70+1	Partially Improved

ignore the figures of the whole group showing improvement in 22.2 percent of our patients averaging 27.1 percentage points, this contention can be proved by the results in individual patients.

It is surprising how closely these figures compare with those of Woods. His favorable group, consisting of those patients showing a consistent improvement of each eye of at least 10 points, makes up 29 percent of his entire series compared to our figure of 22.2 percent showing definite improvement. It is interesting that the average improvement of the favorable

improvement) are quite similar. As Woods was unable to divide his cases on a basis of amount of myopia, these results cannot be compared.

On first study there seemed to be little direct evidence from our results as to the exact mechanism of the visual improvement. It is apparent that there is no change in the amount of the refractive error. There is also no indication of significant change in the ocular neuromuscular mechanism, such as might give rise by relaxation of the lens to a "negative accommodation." The impression gained

from these patients was that much of the improvement occurred at the cerebral level rather than in the retina. Although there was no method for absolute evaluation, it seemed evident that the most visual improvement occurred in those patients who were most intent in their training, putting into it more actual effort and concentration, and vice versa. It also seems

pretraining acuity seemed to get the best results.

Recently Pincus has reported observations of 50,000 examinations on eyes free of organic defects and correctable to 20/20. He correlated the unaided visual acuities with the refractive errors, including myopia, hyperopia, and astigmatism, in amounts up to six diopters. All of our

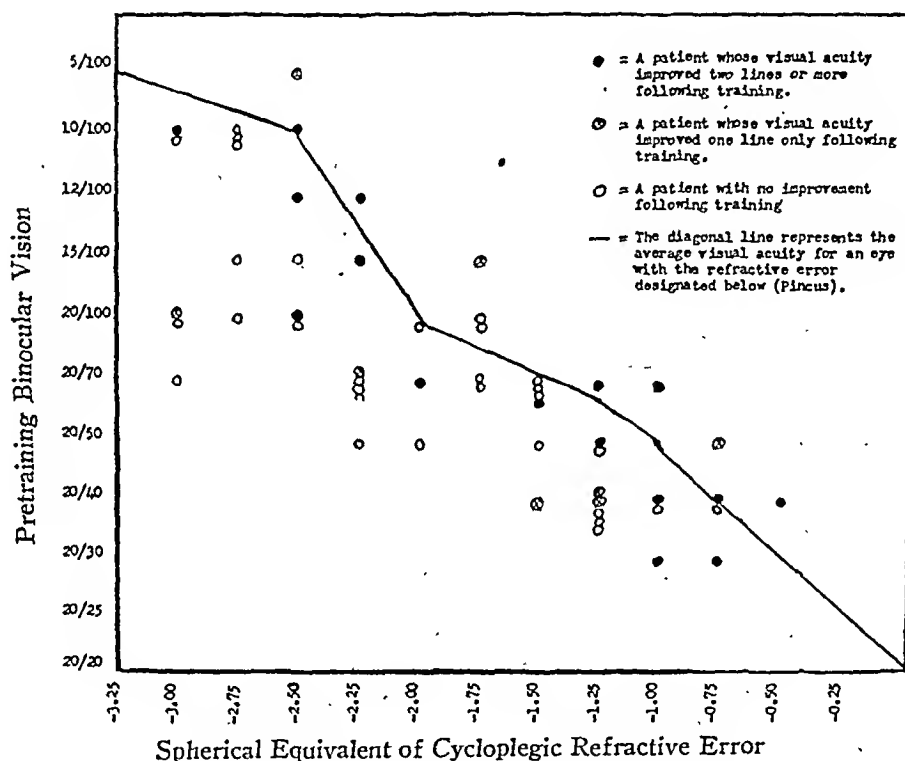


Chart 1 (Hildreth, Meinberg, *et al.*). Results obtained in visual training of existing myopia.

significant that many of the patients whose visual acuity did not change, thought that they could see better after the training. Also the subjective impression of improvement in the majority of the patients was out of proportion to the measurable change. Many stated that they thought they could "use" their eyes better.

One of us (B. M.) in analyzing the results made a significant observation that may well explain the benefit of training and may give the refractionist a criterion for selection of cases for training. It was noted that the patients with subnormal

cases were grouped according to their spherical equivalent and their pretraining acuity. Using the Pincus figures as a norm, it was found that in the 11 patients with an acuity of less than expected for their refractive errors, 8 of these cases (73 percent) showed some improvement. In the 43 patients having an acuity better than expected only 16, or 37 percent, showed improvement. This is expressed graphically in Chart 1.

Realizing that our series was somewhat small, the same one of us subjected Woods' series of cases to a similar analy-

sis, using only those cases that fulfilled our limitations. Since Woods did not report binocular vision, the analysis was done on individual eyes, 110 being available. In the group with pretraining vision worse than the norm, the percentage of improvement was 76.4 percent, while in the group with better vision than the norm, improvement was 38.8 percent. This again shows the remarkable similarity between our results and those of Woods. This also definitely confirms these observations.

Since the great preponderance of improved patients were those whose acuity was not as good as was to have been expected for the amount of their myopia, we may conclude that in these there had been a failure to utilize their visual possibilities to the best advantage and that training had improved the neurologic reception of the images. Better vision is not obtained by changing the anatomy, which remains stable, but by stimulating the visual effort and by improving the interpretation of the images seen.

It is probable that similar training would, in like manner, benefit some hyperopic patients.

The results of the late reexamination, about 1½ years after training, also may have significance. This showed that approximately one half of the patients retained their visual improvement, while only one patient showed worse than pretraining acuity. This would indicate that, at least in a small number of patients, the effect is not transitory. Although the number of patients is very small, these results suggest that an investigation of the possible relationship of visual training to the progression of myopia is indicated. This is without doubt the most important problem in myopia at present and is much more urgent than that of the improvement of visual acuity. Obviously, this question could be definitely answered only after a

carefully controlled study over a period of years.

We must conclude that visual training has a definite, but limited, value in about a fourth of selected myopic patients and none in the remainder. Good effects are preponderantly in those whose vision is less than expected for their known myopia. Considering the time and effort expended by the patient, the results, both in percentage of patients improved and in the actual amount of improvement per patient, must be definitely increased if the procedure is to be generally applicable to the routine management of myopia. It would seem desirable that some efforts be made to increase the effectiveness of the present methods of visual training.

In conclusion we believe that visual training merits further study from the ophthalmologist, particularly in relation to progression in myopia. This should not be left solely to the optometrist and to the psychologist as has been almost the case in the past.

SUMMARY

1. In an attempt to improve the visual acuity, a series of 54 selected cases of myopia was given a course of visual training which was preceded and followed by a complete ophthalmologic examination.

2. The technique of training, which was based on standard accepted procedures in this field, was given by an optometrist while the pre- and posttraining examinations were made by a group of ophthalmologists.

3. Thirty, or 55.5 percent, of the cases showed no change in their acuity, while 12, or 22.2 percent, showed a definite improvement, the best results being obtained in the cases with small amounts of myopia. Twelve patients, that is 22.2 percent, showed a change so slight as to be excluded in the results. The change in the improved group averaged 27 percent.

Eleven of the 12 improved patients were rechecked at an interval of 15 to 23 months following completion of training. Five of these retained their improvement, while only one showed worse than pre-training acuity.

4. There was no change in the refractive error, nor significant alteration in the ocular neuromuscular mechanism. It was thought that the improvement probably occurred because of an improved reception due to stimulation of the visual effort, as the best results occurred in those patients with a pretraining acuity less than would be expected from their refractive

error since 73 percent of this type improved.

5. Visual training has a definite, but limited, value in some myopic patients, preponderantly in those whose vision does not correspond with their known myopia. The effectiveness of visual training must be increased if it is to be generally applicable. Visual training merits further study from the ophthalmologist particularly in relation to progress in myopia.

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The optometrists associated with this project concur fully with the above results, interpretations, and conclusions.

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NOTES, CASES, INSTRUMENTS

EPIDERMOID CYSTS OF LACRIMAL GLAND AND CARUNCLE

DANIEL M. ROLETT, M.D.
New York

The purpose in describing in detail these two cases of epidermoid cysts is to point out the differentiating characteristics (table 1) between the ordinary sebaceous cyst, the dermoid cyst, and the epidermoid cyst of which there is a rather general misconception, since even the

pathologists disagree as to the exact characteristics of these tumors.

An additional point of interest is the knowledge that according to Samuels,¹ dermoid tumors of the eye globe are relatively common; whereas, true dermoid cysts are of rare occurrence, probably being, in his opinion, rarer than intra-ocular retinoblastoma or sarcoma. The typical location of the cyst is in the upper temporal quadrant of the orbit near the lacrimal gland. These cysts may not be always well defined, which makes their

TABLE 1

POINTS FOR THE DIFFERENTIAL DIAGNOSIS OF SEBACEOUS, DERMOID, AND EPIDERMOID CYSTS

Sebaceous Cyst	Dermoid Cyst	Epidermoid Cyst
1. Lined with stratified squamous epithelium. Walls thin.	1. Lined with stratified epithelium. Walls thick and contain sweat glands and hair follicles.	1. Lined with stratified epithelium. Walls moderately thick.
2. Does not contain the fatty, sebaceous, and odorous material, that is typical of a sebaceous gland.	2. Invariably contains a cheesy material of a sebaceous character.	2. Contents are sebaceous but not odorous.
3. Contains layer upon layer of useless, nonfatty, odorless, infected keratin. Commonly called keratomas.	3. Contains sebaceous and sweat glands and hair follicles. The <i>congenital</i> dermoid cyst of teratoma type may encapsulate teeth, nails, glandular, and brain structure.	3. Contains no hair follicles, sebaceous or sweat glands.
4. Occur in the subcutaneous tissues of any part of the body, mostly in the scalp and in the lobe and on the posterior surface of the ear.	4. Develop along the embryonic clefts and lines of fusion. The <i>teratoma</i> type takes its origin from the embryonic germinal epithelium. Usually occur in the testes and ovaries.	4. (a) <i>Acquired</i> inclusion cysts mostly involve the orbital region and eyelids. These regions are the fusion sites of various embryonic structures. (b) <i>Congenital</i> inclusion cysts are located anywhere in the sebaceous tissues.
5. They are freely movable under the skin, although attached to the skin at one point.	5. Not freely movable. Solidly attached to the surrounding tissues.	5. <i>Congenital</i> inclusion cysts are not attached to the overlying skin. The <i>acquired</i> inclusion cysts are the result of an injury. In the process of formation they may carry a portion of the skin into the deeper tissues where the dermal cells subsequently form a cyst lined with squamous epithelium. They occur most commonly about the head and neck.
6. Increase rapidly in size, have a tendency to become infected, and are painful. They have an enlarged pore through which exudes a cheesy material, upon local pressure.	6. May have a hair sticking out. Do not become infected.	6. Possess a sinus from which a hair may protrude. Local pressure will express a cheesy material. Enlarge rapidly and frequently become infected.

diagnosis difficult. In a number of cases, diverticula of these cysts were found to extend deep into the orbit (Knapp,² Gifford,³ and Collado⁴).

The dermoid cyst tends to grow larger at the age of puberty. Depending upon its location, it may become tender and painful. Histologically, these cysts pre-

ma and infection, they resist the invasion of pathologic processes. Wätzold⁶ found only six cases in 60,000 patients. Vail⁷ saw one case in 15,000 patients, and Serra⁸ compiled 136 cases from the literature, including three cases of his own.

CASE REPORTS

CASE 1

P. L., a man, aged 29 years, was first seen in March, 1946, complaining of tearing and burning of the right eye with occasional sharp, shooting pain in the right upper lid. There was a feeling of fullness and a sensation of the presence of a foreign body in the right upper quadrant of the eye.

Examination. The right eye revealed a slight puffiness of the upper lid with a tenderness on deep pressure at the upper outer corner. The bulbar conjunctiva, temporally and above, was congested with enlarged blood vessels. Eversion of the lid with simultaneous extreme rotation of the eye, nasally and down, revealed a mass at the outer upper quadrant of the eye, apparently nonadherent, but painful to touch. Several hairs were seen protruding from it. The rest of the eye was normal. Vision was 20/20. The left eye showed no pathologic condition. Vision was 20/20.

An operation was performed under local anesthesia. The lacrimal gland was



Fig. 1 (Rolett). An epidermoid cyst of the lacrimal gland. (A) Sebaceous gland. (B) Large cyst (Magnification $\times 56$).

sent the following essential features: (1) An inner epithelial lining; (2) in the wall are imbedded hair follicles; (3) sebaceous and sweat glands; (4) the inner epithelial lining may be partly replaced by granulation tissue and, in cases of secondary infection and ulceration, may contain epithelioid and giant cells. In some cases, degenerative changes are brought about by the increased intracystic pressure due to persistent accumulation of sebum and desquamated epithelium, New,⁵ and others have found that 49.5 percent of the acquired dermoids involve the orbital region and eyelids. The dermoid cysts will develop in these regions because they are the fusion sites of various embryonic structures.

Tumors of the caruncle, according to the literature, are exceedingly rare. The lacrimal caruncle and the semilunar fold take their origin from ectoderm and mesoderm. Although quite susceptible to trau-

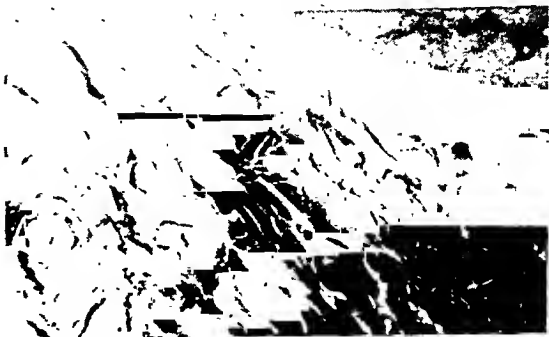


Fig. 2 (Rolett). An epidermoid cyst of the lacrimal gland. (A) Hair follicle. (B) Large cyst (Magnification $\times 220$).

located, and a medium-sized cyst, partly overlying it and partly fused with it, was located and removed intact.

Laboratory report. Gross examination showed the specimen to consist of a soft elliptical nodule, 4 mm. in its maximum dimensions and composed of gray and yellow tissue. Zenker fixation was used.

Histologically, the tissue is composed of collagen and fat covered by a delicate stratified squamous epithelium. Included in it is a cyst lined by thinned-out stratified squamous epithelium and filled with shreds of keratin. There is no inflammatory reaction about it, but in the corium, patchy edema and scattered lymphocytes, plasma cells, and large mononuclear cells with a few polymorphonuclears are noted.

Diagnosis. Epidermoid cyst of the lacrimal gland (figs. 1 and 2).

CASE 2

C. M., a man, aged 30 years, was first seen in May, 1946, at which time the patient gave the history of having noticed in the inner corner of the left eyeball a small swelling which had become progressively larger and more painful.

Examination. The right eye appeared normal. Vision was 20/20. In the left eye, the lids were normal but the bulbar conjunctiva, nasally, was moderately congested. Through this area coursed enlarged blood vessels. The caruncle and the area around it were red. The caruncle itself was about three times the size of the one on the right side, which was normal. Palpation and slight pressure over the area elicited pain and tenderness. There was also pain on extreme motion of the eye to either side. Slitlamp examination of the area revealed an enlarged porous opening through which a thick yellowish fluid exuded on pressure. The rest of the eye was normal. Vision was 20/20.

The clinical diagnosis at the time of the examination was infected cyst of the caruncle. An operation was performed, and the cyst was removed.

Laboratory report. Gross examination of a specimen of tissue from eyelid shows a spherical cystlike structure, 3 mm. in diameter. It is covered externally by an opaque, gray, large, shiny membrane that presents a few short fibrous



Fig. 3 (Rolett). An epidermoid cyst of the caruncle. (A) Sebaceous gland (Magnification $\times 56$).

tags. It is fixed uncut. Zenker fixation was used.

Histologically, the cyst has an epithelial lining made up of a thin layer of stratified squamous cells. It is filled with a quantity of keratin that is loosely arranged with spaces between the keratin layers, suggesting the presence of fluid. Outside the epithelium is a delicate fibrous wall containing a few compressed glands of modified sebaceous type.

Diagnosis. Epidermoid cyst of caruncle (fig. 3).

SUMMARY

Two rather rare cases of epidermoid cysts of the lacrimal gland and the caruncle have been presented with a description of their gross and histologic appearance. A brief review of the points of differential diagnosis between the most important cysts found in the orbit has been given.

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THE VITAMIN IN OPHTHALMOLOGY

It is a pleasure to recommend *Le Vitamine in Oftalmologia*, by Giambattista Bietti. (Bologna, Licinio Cappelli, Editore, 1940. 539 pages, paperbound. Price, L.80). It is a comprehensive and readable treatise on the vitamins in ophthalmology. The ophthalmologist may well bog down at the mere thought of facing a book of more than 500 long pages on the vitamins, yet here is all he wants to know so clearly stated, so perspicuously arranged, that the contemplation of the monograph is truly refreshing. After a brief general introduction, each of the five vitamins important in ophthalmology, A, B₁, B₂, C, and D is thoroughly discussed in a separate chapter. Each chapter follows the same pattern. In a general part the biochemistry of the vitamin, its relation to the normal and abnormal function of the several systems of the body, and its therapeutic indications are discussed. In an ophthalmic part, the lesions and pathologic processes in the eye in which the vitamin or its absence may play a part are thoroughly discussed. Research on incompletely elucidated problems is described. A brief chapter is devoted to the vitamins of minor interest in ophthalmology, namely E, H, J, K, L, and P.

In a final chapter the correlation among the vitamins and their relation to hormones and ferments is discussed. Each chapter has an adequate bibliography and there is a general bibliography at the end of the book. Finally, as in the condensation of Toynbee's *Study of History*, there is a condensation of the condensation. A large table displays all important data at a glance.

F. H. Haessler.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

COLORADO OPHTHALMOLOGICAL SOCIETY

January 18, 1947

DR. GEORGE STINE, *presiding*

DETACHMENT OF CHOROID AND RETINA

DR. GEORGE STINE read an interesting paper with a case report of this subject (published in the JOURNAL, 1947, Volume 30, July, page 987).

Discussion. Dr. Fritz Nelson offered the idea that the term choroidal detachment is really a misnomer as the condition actually is an edema of the retrochoroidal space. If a membrane detachment extends beyond the midline, it must be the retina which is detached since the vortex veins would always be ruptured with disastrous results if a choroid were detached to that extent. He had examined the patient referred to in the case report about one year after the first operation. The patient was doing very well; vision and fields were normal enough.

Dr. Stine (in closing) said that probably no more than two veins could be thus ruptured; however, there was no harm in doing a posterior sclerotomy and draining off the retrochoroidal blood.

RETROLENTAL FIBROPLASIA

DR. VON HALER BROBECK presented M. S., aged 20 months, one of premature twins who weighed two pounds at birth. The other twin died at birth. The exact gestation period was not known. The mother is a deaf mute. When first seen the child was obviously blind and had a marked nystagmus as well. Examination under anesthesia revealed large gray-white masses behind both lenses, with retinal vessels visible in the mass. A differential

diagnosis would have to be between retinoblastoma and retrolental fibroplasia. The child's birth history would seem to indicate retrolental fibroplasia.

Discussion. Dr. George Stine said that he had examined the child and that he felt the condition was certainly retrolental fibroplasia; that the prognosis for vision was certainly hopeless; and that he did not recommend surgery. Dr. Ralph W. Danielson agreed and added that most of these cases also have mental retardation so that the condition might be called, "cerebro-oculo-dysplasia," although the late Dr. Terry disagreed with this idea.

TUNICA VASCULOSA LENTIS

DR. WALTER A. OHMART presented C. A., aged 17 months, who was born prematurely at six months, weighing 2 lbs. 2 oz. The child remained in an incubator for three months; it was obvious almost from birth that vision was deficient. Development was quite normal in all other ways and the child now feels its way along when walking. The pupils react easily to light and accommodation, but it is obvious that the child has light perception only. Examination shows both lenses to be clear with several anterior synechias. Both fundi present either large masses in the vitreous or large retinal detachments, involving the whole retina in the left eye and lower half in the right. The optic-nerve heads cannot be seen in either eye, and X-ray films show no calcium. Examination under transillumination has been very unsatisfactory. The diagnosis is not determined, but the condition must be bilateral serous detachment, or retinoblastoma, or tunica vasculosa lentis.

Discussion. Dr. William Bane, who had examined the child, felt this case was not one of a malignancy. Dr. W. H.

Crisp felt it was most likely tunica vasculosa lentis and felt no surgery should be done. Dr. George Stine felt that since an error might be fatal, the worse eye should be enucleated to determine the tissue diagnosis and thereby possibly save the other. Dr. Leonard Swigert suggested that the history pointed toward a benign lesion, but that since the tumor seemed to be posterior to the lens, the condition pointed to glioma. Dr. Ralph W. Danielson said that X-ray studies are not conclusive. He has a patient in whom X-ray studies showed no calcium and yet, after enucleation, the bulb was found to be almost solid. Calcium would be evidence of degeneration of the tumor and thus of the cure and not the progress of the tumor. In this case, the loose retina does not point to glioma. Since the pupils dilate to light, there is strong evidence that the condition is one of retrolental fibroplasia. A glioma of this extent could only result in blindness. He suggested that a biopsy be done. Dr. Ohmart (in closing) said that the idea of a biopsy was very good and might be attempted.

FUNCTIONAL AMBLYOPIA

DR. MORRIS KAPLAN presented L. P., aged 11 years, who has complained of poor vision for a long time. Vision was 10/400 and 6/400. The child was in fifth grade and seemed to be able to maintain average grades. Ocular examination was entirely negative and refraction under atropine revealed $-3.50D$. in each eye, with no appreciable improvement in vision. A history of night blindness was questionable, and there certainly was no abnormal retinal pigment. Trial contact lenses brought vision to 20/25 in each eye. Was this a case of retinitis pigmentosa without pigment; or did it show a type of hysterical functional amblyopia?

Discussion. Dr. W. H. Crisp said that if refraction revealed a simple myopia with normal retinoscopic reflexes, then

conical cornea could be ruled out. Dr. William Bane said that the girl's school accomplishments would seem to indicate that no pathologic condition was present but that the condition was a purely functional ocular laziness and suggested the use of a collyrium with very stinging properties.

IRIDESCENCE OF ANTERIOR CHAMBER

DR. R. W. DANIELSON presented J. C., a man, aged 21 years, who had been seen five years before immediately after a dynamite-cap explosion at which time a jagged piece of copper was removed from the sclera near the ciliary body. Subsequent X-ray pictures were negative for a foreign body. The resulting vision was 0.8. Six months later the patient suffered a vitreous hemorrhage which resulted in retinitis proliferans and vision of light perception. Three days ago his eyes became red and painful and examination revealed the anterior chamber to be solid with an iridescent mass, which was filled with variegated crystals and presented an amazing color pattern in the beam of the slitlamp. The cornea was quite clear and no reflex could be seen past the opaque lens. Tension was 28 mm. Hg (Schiotz). His other eye has remained entirely normal.

Discussion. Dr. Leonard Swigert suggested the possibility of aspirating some of this anterior chamber material and determining its makeup.

UNUSUAL FORMATION OF RETINAL VESSELS

DR. W. H. CRISP presented Mrs. G. A. B., aged 55 years. When first seen, in 1931, the patient had shown great tortuosity of the retinal veins of the right eye, especially in the region of the disc, where there were several very prominent vascular loops, the highest of these having a prominence of about 5D. At that time the refraction of the right eye was nearly

normal; the visual acuity was 5/3, mostly, with correction; and the visual field was normal. There were several vague symptoms, perhaps attributable to a rather marked refractive difference between the two eyes. The retinal vessels of the left eye were somewhat tortuous, but much less so than those of the right eye. At various times between January, 1931, and May, 1938, the patient's eyes underwent moderate refractive change, but her condition showed generally very little modification. At one time some very tiny spots, probably hemorrhagic, had been noted in the retina, and the veins of the right eye showed marked kinking, but no narrowing, at the arteriovenous crossings. In June, 1938, Wassermann and tuberculin tests were negative, the blood pressure and basal metabolism were low. X-ray studies of the intracranial and facial region were negative as to pathologic conditions in the sinuses, orbit, and pituitary region, except as to the presence of a calcified pineal gland. There were some attacks of scotoma scintillans, and in October, 1938, there was some suggestion of moderate enlargement of the right blind spot. There were no other cranial symptoms such as headache, nausea, or dizziness. In September, 1939, the patient underwent a thyroidectomy. The vision of the right eye was then still 5/3, mostly, with correction.

The patient was in Washington for five years during World War II. In July, 1945, she came with the record of having noticed diminishing vision in the right eye for the past 8 or 9 months. The corrected vision at this time was: R.E., 5/6; L.E., 5/3. The psychiatrist who had examined the patient some years previously saw her again and reported finding only what he regarded as an anxiety neurosis so far as the neuropsychiatric condition was concerned.

By December, 1946, the vision of the right eye had fallen to less than 1/60,

while the vision of the left eye remained as before. The visual field was limited to a small central area. The right pupil still reacted briskly to consensual stimulus, the X-ray findings were still normal, and there was no significant neurologic evidence. The vessels on the right disc were perhaps slightly less prominent than at earlier records. The optic disc between the groups of prominent vessels was very pale. In the absence of other explanation, it had been conjectured that the ocular and visual changes arose from some sort of vascular anomaly behind the eye; although there was no ocular protrusion, no limitation of movements, and no fundus details suggesting Hippel's disease or other fundus disturbances beyond those here described.

Almost no vision remained in the right eye at the time of presentation of the patient, while no disturbance was found as regards the left eye, and the patient was otherwise in good physical condition.

Discussion. Dr. V. H. Brobeck asked if this might be angiomatosis. Dr. George Stine asked the feasibility of X-ray treatment. Dr. William Bane suggested that this must be a lesion in front of the chiasm as the left vision had remained normal. Dr. Crisp (in closing) remarked that the case did not resemble angiomatosis and that X-ray therapy might be considered.

Morris Kaplan,
Secretary.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

February 20, 1947

DR. BURTON CHANCE, *chairman*

PAROXYSMAL LACRIMATION WHEN EATING.

FRANK C. LUTMAN, CAPT. (M.C.),
A.U.S. (by invitation) read a paper on

"A Syndrome of Paroxysmal Lacrimation When Eating Associated with External Rectus Paralysis (the gusto-lacrimar reflex of 'Crocodile Tears')." An abstract follows:

Paroxysmal lacrimation when eating, which is occasionally seen as a sequel to a peripheral facial nerve paralysis upon the same side, is an abnormal form of reflex in which tearing accompanies salivation. The explanation for the abnormal facial movements following peripheral facial motor paralysis and other pathologic associated reflexes is also applicable here. From all cases now available, the evidence would suggest that this reflex tearing is established by either some of the regenerated axones to the salivary glands becoming misdirected to the lacrimal gland, or that single axones at the point of the lesion may branch and innervate both the lacrimal and salivary glands. However, the center for this reflex, if peripheral, remains obscure.

Two cases were described. The first was a congenital unilateral paroxysmal lacrimation when eating with a homolateral paralysis of the external rectus muscle. The second had bilateral external rectus paralysis and bilateral reflex tearing when eating. Upon reviewing the literature on lacrimation when eating, a third and similar bilateral case was found. In all three cases the condition was first noticed in infancy.

It is suggested that the pathologic processes in these three instances is produced by a pontine lesion, involving the abducens nucleus and the superior salivary nucleus of the seventh nerve, or by a lesion of the abducens nucleus and the genu internum of the facial nerve as it passes around the abducens nucleus.

The three cases of paroxysmal lacrimation when eating associated with external rectus paralysis are presented as evidence of the existence of a new congenital neuro-ophthalmologic syndrome.

For treatment, if the reflex tearing can be interrupted by cocaineization of the sphenopalatine ganglion, injection with alcohol offers a more permanent means of control. When indicated, the external rectus paralysis should be treated by tendon transplants from the superior and inferior recti muscles.

Discussion. Dr. Robert A. Groff: Captain Lutman has presented a rather interesting and new syndrome, so far as I am aware, when he adds to the familiar paroxysmal lacrimation during chewing movements, a homolateral external rectus paralysis.

I became interested in the syndrome without the external rectus palsy some 6 or 7 years ago when I saw a patient who teared whenever he ate an apple. This patient gave a history of having had a facial palsy from which he had completely recovered some 8 or 10 months before. As Captain Lutman suggested in the treatment of this condition, we, at that time, injected the sphenopalatine ganglion and produced temporary cessation of the phenomenon during the time the novocaine was acting. Since this was successful, the second injection was made with $\frac{1}{2}$ to 1 cc. of absolute alcohol, and for a period of about three months the patient was symptom free. After that he disappeared from the clinic, which may indicate that the difficulty did not return.

As to the association of the syndrome with a sixth-nerve palsy, rather than a facial palsy, I have had no personal experience. This is new, although I say it with hesitancy since I have not reviewed the literature. My reaction to Captain Lutman's explanation that this is caused by a central lesion is not in agreement. Certainly, the associated tearing with seventh-nerve lesions has been more or less proved to be a peripheral reflex phenomenon. The possible pathways are chordatympanic nerve, sphenopalatine ganglion, and then through the zygomatic

nerves to the lacrimal gland. It may be that in some way the fifth cranial nerve is involved, in view of the studies that Dr. Lewey and I carried out in connection with the Marcus Gunn phenomenon in which we demonstrated autonomic fibers in the branches of the fifth nerve which, when stimulated, caused eyelid movements after the third cranial nerve had been sectioned several weeks before. For this reason and because a central lesion would necessarily have to be minutely small to produce this syndrome without giving other neurologic signs, the entire phenomenon could better be explained on the basis of a peripheral perversion reflex. Furthermore, the fact that relief was obtained by injection of the sphenopalatine ganglion tends to support this view.

I wish to thank Captain Lutman for the privilege of discussing this interesting presentation.

Dr. Walter I. Lillie: I would just like to assure Captain Lutman that he has been fortunate in seeing so many cases because they are very rare indeed. I was very much interested as I have only seen one case with an external rectus paralysis and lacrimation. I feel as Dr. Groff does that it is a peripheral lesion. I personally do not see how one could conclude that there is pontine reaction in the region of the sixth nucleus where the seventh crosses around it. The pons is a very small portion of the central nervous system. A lesion large enough to include the seventh nerve crossing around the sixth nerve plus the salivary center produces a lot of contralateral motor and sensory disturbances in the individual, and that to my knowledge has not occurred. I think Dr. Lutman is to be congratulated on seeing as many cases as he has.

Capt. Frank C. Lutman (closing): With Dr. Lillie and Dr. Groff I also believe this is a peripheral reflex. A lesion of the pontine facial nucleus would produce a peripheral facial paralysis which

as I brought out in the paper is a requisite for this type of paroxysmal lacrimation to develop. As I understand Dr. Groff's contention, it would require two lesions to explain a combination of the abducens paralysis and the facial paralysis. To my mind it would be simpler to attribute this to a single lesion, and the point where the facial and sixth nerves are the closest together is in the pons.

However, as has been mentioned, this tearing is rather complicated, and I hope in the future a careful neurologic examination will be done in the new cases that are found.

I wish to thank Dr. Groff and Dr. Lillie for discussing the paper.

MENINGEAL FIBROBLASTOMA ARISING FROM SPHENOID BONE

DR. ROBERT H. TRUEMAN, presented an analysis from an ophthalmic point of view of the syndrome of meningeal fibroblastoma arising from the lesser wing of the sphenoid bone.

The historical aspects of suprasellar and parasellar meningiomas were considered with particular emphasis on the early observations of those arising from the sphenoid ridge.

The terms suprasellar and parasellar were defined, with a description of the sphenoid ridge. The anatomy of the region of the lesser wing of the sphenoid bone and sella turcica is reviewed and the pathology of meningioma was discussed.

The syndrome of early meningioma of the lesser wing presents such findings as optic atrophy, field changes, exophthalmos, involvement of ocular motility, sensory disturbances in the distribution of the second and first divisions of the trigeminal nerve, involvement of taste and smell, all on the side of the tumor. The appearance of pituitary and frontal lobe and motor and sensory symptoms and signs were also discussed.

The symptomatology of 56 cases was

analyzed to show that in 82 percent of them the first symptoms to appear were of an ocular character. The objective findings were then analyzed to show that 91 percent of the cases showed fundus changes, 86 percent showed visual field changes, 43 percent showed exophthalmos, and 38 percent showed some involvement of ocular motility. Among the findings, other than ocular, were trigeminal paresthesias, pituitary signs, involvement of taste and smell, frontal lobe signs, sensory and motor findings.

The X-ray findings were then discussed with particular reference to both generalized and localized changes among which are the erosions and the local and general hyperostoses.

The differential diagnosis was taken up in relation to intraorbital tumors, intrasellar tumors, aneurysms, optochiasmic arachnoiditis, gliomas, and craniopharyngiomas.

Discussion. Dr. Robert A. Groff: Dr. Trueman is to be congratulated upon his excellent presentation. Certainly, he has clarified the syndrome since Dr. B. J. Alpers and I first called attention to it some years ago.

The successful surgical removal of these tumors depends upon early diagnosis, because then the technical problem is simplified greatly. The lesion is small and, as a result, the opportunity for complete removal is much more favorable.

The picture presented to you includes cases of late diagnosis. In fact, some of them were made at a time when it was not possible for the surgeon to operate upon them. Let me give you the early signs which are sufficient to make the diagnosis. Early primary optic atrophy of papilledema, a visual field cut on the temporal side of the affected eye, and a top normal sella turcica are all that is necessary to demand further studies to verify the diagnosis by encephalography.

When a unilateral exophthalmos is de-

veloping in a patient, the possibility of a sphenoid lesser wing meningioma should be excluded first. X-ray films of the skull will aid in the diagnosis for, in my experience, the ridge shows definite thickening incident to tumor infiltration.

At the operation these tumors are interesting. They present either one of two types. The first is a bulbous growth, and the second is an en-plaque variety in which the tumor is flat, spreading over the surface of the dura. This latter type is usually associated with underlying bone infiltration which produces exophthalmos.

In order to cure these patients, it is necessary to remove the dura to which these tumors are attached. The bulbous variety offers a less difficult problem, from this stand point, than those which grow by spreading over the surface of the dura. The former, therefore, if not large can usually be removed completely. The latter are almost never removed completely and, therefore, recur. Since this type of tumor is a rather slow grower it is, in most instances, several years before a second operation is necessary.

When the bone has been invaded by the tumor, it is practically impossible to remove all of the involved bone because of the adjacent structures, internal carotid artery, nasal chamber, and sinuses and sphenoid fissure. Although a routine decompression of the orbit is done in those patients who have an exophthalmos, it does not relieve this sign completely but only partially.

Dr. Trueman stated that the cause for the exophthalmos is probably venous engorgement. As one observes the orbital contents in these patients, this explanation seems most likely, because the structures are edematous and under tension as though there was obstruction to the venous drainage system of the orbit.

A plea is made for the early recognition of these tumors. As Dr. Trueman has

stressed in his paper, when a patient comes to you with a slight primary optic atrophy, a temporal field defect in the same eye, and the X-ray pictures of the pituitary fossa are normal or top normal in size, have him investigated for the possibility of a lesser wing sphenoid ridge tumor without delay.

I wish to thank Dr. Trueman for the privilege of discussing his excellent presentation.

Dr. Walter I. Lillie: I would like to add my appreciation for Dr. Trueman's presentation, and to go one step further in what he has called the early part of the ocular syndrome.

The early thing is the retrobulbar neuritis syndrome on the side of the lesion. That is characterized by a lowering of the visual acuity. The visual fields will usually show a central scotoma, although they may have otherwise normal findings. This is the ideal time for the diagnosis to be made as it permits the neurosurgeon to enter and remove the tumor before it has been of long enough duration to have produced optic atrophy. Optic atrophy is irreversible, a condition which I wish to stress even stronger than Dr. Groff did.

The ophthalmologist sees these cases first, and he is the one responsible if they are delayed in reaching the neurosurgeon. In the early stages there is usually a normal fundus, and it is necessary to differentiate the lesion from an inflammatory type of condition or a toxic thing. Against that type of clinical syndrome, the onset of this, as Dr. Trueman has brought out and Dr. Groff has also stressed, is very insidious, and it progresses slowly. This indicates tumor rather than inflammation or vascular lesion. I feel that in these cases a very thorough neurologic examination is necessary, and should be requested by the ophthalmologist. I also strongly advocate doing an encephalogram early. I believe that this

is helpful in basal arachnoiditis in the sulcus chiasmatis, in lesions of the sphenoidal ridge, and in calcification. If it shows a massive type of space-taking lesion, it is a great aid. I concur with both speakers, but I feel that it should be stressed to take heed of the earliest eye syndrome and not to wait for the appearance of optic atrophy. If a case can be operated before atrophy has taken place, that patient has a very excellent chance to recover normal vision and that is the ideal end result.

Dr. Burton Chance was reminded by this history of a case of his own. He had been consulted by a lawyer who was engaged in a suit concerning the death of a woman after the collision of the automobile in which she was riding with her family, and a horsedrawn vehicle. Photographs made by bystanders absolutely confirmed the transportation company's contention that the company was not at fault, nevertheless a verdict was entered against the company.

Before the injured one's death it was declared that her sight had been destroyed, and that she was blind. Dr. Chance succeeded in obtaining the record books of an ophthalmologist, then deceased, who, 11 years before the accident, had been consulted by the woman. He recorded that she was blind in her right eye, because of complete atrophy of the optic disc, which he regarded as dependent on the high degree of progressive myopia of each eye. At that time there were no roentgen facilities, and further study was not made. Against the opposition of the plaintiff's family, an autopsy was obtained. Attached to the sphenoid was found a tumor of about the size of a large white grape extending by erosion into the orbit. Sandlike changes were felt over the surface of the tumor. By some strange sleight-of-hand the tumor was spirited away, and was never recovered!

Dr. Robert H. Trueman (closing):

Thank you, Dr. Groff and Dr. Lillie, for your discussions. You have both emphasized, as I have tried, the importance of the early changes in the diagnosis of this tumor.

I would like to call attention to the fact that this analysis includes cases representing all sizes of these tumors from the largest, in the early Cushing series, to the smallest in the series of Groff and Elsberg, and Dyke. This explains the varied types of clinical pictures found, from the very early fundus and field changes to bilateral blindness. While it is important to recognize the very early changes, one should know that, as the tumor grows, progressive changes occur, for it is possible that a case might just as well be seen late as early.

I would like to ask Dr. Lillie one question. In your experience, have you ever been able to pick up a case of meningioma of the lesser wing that had only a central scotoma?

Dr. Lillie: Yes, I have.

Dr. Trueman: That answers my question. Thank you.

NIGHT VISION FOR MILITARY PERSONNEL

ROBERT H. PECKHAM, PH.D., associate professor Physiological Optics, Department of Ophthalmology, Temple University Medical School (by invitation) presented a paper on "The Protection and Maintenance of Night Vision for Military Personnel."

This address is a report of the recommendations and research performed by the Vision Committee of the National Defense Research Committee for the military services during the war. The author acted as liaison officer between the Committee and the Bureau of Medicine and Surgery.

As a result of the deliberations of this group of civilian and uniformed scientists, the following action was undertaken by both the Army and the Navy.

1. All personnel were instructed in the use of the eyes at night, with especial attention to waiting for dark adaptation and to using the rods of the retina by "looking around things."

2. An attempt was made to supply night-combat personnel with red goggles, to preserve dark adaptation, and to permit the attainment of adaptation in lighted compartments.

3. All Navy personnel were examined to eliminate night-blind persons.

4. As a result of directed research, it was decided that sunglasses for day wear were necessary to permit the best night vision. These sunglasses were neutral in color, not green or amber, of 10-percent transmission, and polarized, with the plane of transmission vertical. Finally, no specification against transmission in either ultraviolet or infrared was included.

5. The facts learned during the war can be applied to peacetime pursuits. Since the effect of sunlight is to reduce the sensitivity of the retina, sunglass protection is recommended for fluoroscopists. The effect of sunlight is to reduce the efficiency by about 30 percent. Sunglasses are needed by all persons doing colorimetry, or any visual task involving comparative judgment. The effect of sunlight reduces retinal efficiency by from 20 to 50 percent, depending on the task.

In a determination of avitaminosis by measuring the course of dark adaptation, the effect of previous exposure to sunlight could conceivably be so great as to completely confuse the readings. Sunlight exposure can be effective for as long as three weeks after the period of exposure, and the effect of vitamin therapy can, therefore, be lost to demonstration.

All persons driving in dusk and at night, after a day in unprotected sunlight, will lose at least one half of their night visual efficiency, thereby rendering their driving dangerous and uncertain.

Discussion. Dr. Burton Chance, in commenting on the statement that persons exposed for long hours in the glaring sunlight were found to have distinct loss of power at night, remarked that he had noticed on his repeated visits to tropical islands that his native friends seldom would enjoy walking out with him at night, because they declared they could not see well at night.

On long voyages, as once on a sailing ship before he became an ophthalmologist, he noted how sailors, who had been most capable during the daylight hours, became less efficient during the night, especially after the periods when their daytime watches were prolonged.

In World War I, at his Army Hospital located at the seaside, men from northwestern climates who delighted in spending all the daylight hours on the beach, would prefer to remain indoors at night. Dr. Chance believed that the daylight glare interfered with the photochemical reactions in the retina.

Dr. Walter I. Lillie: I would like to have a word before Dr. Peckham's closing remarks. We have read so much in the newspapers that the Negro race, the yellow race, and the brown race have much better night vision than the white race. I just wondered whether any of his investigations would prove or disprove those statements?

Dr. Robert Peckham (closing): We made a lot of measurements designed to distinguish racial differences. The first measurements were made by the Army for the purpose of selecting drivers of trucks and jeeps under blackout conditions at Fort Meyers. They deliberately chose members of the Negro race, because it was suspected that, being highly pigmented, they would have deeper choroidal pigmentation and be better able to see at night. The tests showed no difference. Many more careful and extensive tests

were made during the war until it was finally concluded that no one race showed any superiority of retinal sensitivity.

Some races were better able to perform out of doors at night, being better trained for night vision, because of their savage environment. At one time early in the investigations, we received a hurry up call from the British that the suggestion had been made that the Japanese were night blind. Because they were myopic, something ought to be the matter with them. Fortunately, a few retinal sensitivity records of Japanese students were available, but these showed no differences in retinal sensitivity.

During the Pacific campaign the Marines reported hearing Japanese broadcasts to the effect that the American Marines should stay indoors at night. It was reported that certain selected Japanese Shinto fighters had been selected for retinal operations, including the injection of secret drugs, and were then trained to be night killers. These people, it was boasted, had such tremendous retinal sensitivity that they could not go out of doors in the daytime, and therefore would not be seen. This sounded like a fairy tale, but it had to be investigated. It was concluded that it was in reality a falsehood, invented by the Japanese, because they had discovered that they had actually lost their night retinal sensitivity. They had occupied the islands for months, and even years, waiting and watching for us to come. They were aware of their night-vision loss, because we found their fox-holes literally lined with boxes of vitamin-A concentrates. We had ourselves tried the use of such concentrates, and found that they were useless to replace lost retinal sensitivity. Only time, and considerable time at that, will permit the retina to regain its lost sensitivity.

George F. J. Kelly,
Clerk.

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THE STUDY OF OCULAR MOTILITY

The members of the American Board of Ophthalmology are in a unique position to compare and evaluate the training of ophthalmologists from all over the country. There is, of course, the uniformity of the topics taught and examined in, as set forth by the prospectus of the Board. Naturally, too, there is a wide variation in the assimilation of the neces-

sary knowledge and techniques of ophthalmology by the candidates. The Board members have a very good idea of what institutions and preceptors turn out the best product. The quality of the teaching and opportunities is reflected in the standing of the candidates as a rule, although there are many exceptions.

Among the subjects that cause some

confusion and express the most variations in training throughout the country is that of ocular motility. This, however, should occasion no surprise because at the moment the leaders and teachers, themselves, are somewhat confused over the subject, which is inherently difficult to comprehend in all of its complexities. There is a modest conflict between investigators of the objective method of examination and diagnosis, as exemplified by Duane, White, and many others, and the followers of the neuromuscular and subjective method of examination and interpretation, as represented by Bielschowsky, Lancaster, Burian, and Adler.

The contributions of Duane and White have been important and helpful in the understanding and measurement of squint. The fact that it is a method of objective measurement with screen and prism has the fault that, in following this method, there is a tendency for one to discount or overlook the associated disturbed physiology or anatomic lesions in the ocular muscles or central nervous system underlying the objective signs. Adler brought this out very well in his Jackson Memorial Lecture, recently presented before the American Academy of Ophthalmology and Otolaryngology, when he discussed the "underaction" phenomenon in the nonfixing, nonparetic eye.

On the other hand the contributions of the neuromuscular school are probably more comprehensive and accurate, although more complex. The method of charting diplopia fields, advocated by the authorities, is not easy and the interpretation of these diplopia fields is certainly not automatic. Lancaster's chart with red and green goggles and targets simplifies the diplopia test and comes close to making it a satisfactory objective method of measurement and analysis. It needs a patient who is reasonably intelligent and who understands what is required of him.

Perhaps most of the candidates at the last examination of the Board followed more or less the objective method of measurement. Many had what has been lightly termed "P. trouble" or prism trouble, or "F.F.P." (fist full of prisms), and the usual difficulty of a fixation light and not enough hands was frequently encountered. Few were at home with diplopia tests, and while many showed some knowledge of the work of the neuromuscular school from their study and reading, not many had considered this side of the story intently.

The student suffers from lack of clear writing and description of both methods; especially the neuromuscular one, in our modern textbooks. The Duane-White method is only to be found in a few of the new textbooks on ophthalmology, and the neuromuscular method in this event is given scanty mention. The manual, *The Extrinsic Eye Muscles*, of the Home Study Course of the American Academy of Ophthalmology and Otolaryngology, prepared by H. Saul Sugar, covers both features of this somewhat thorny subject pretty well. There is, however, a need for a good and clear treatise. That this need is obvious is shown by the experience of the Board examination.

In view of the present and laudable state of controversy, no one method is entirely satisfactory in all cases or for all examiners. It would seem best, therefore, for the beginner to master the objective method first and then deeply study the "neuromuscular" methods until he has mastered them in so far as possible. In this way the best features of both methods will be preserved and followed, and a better interpretation of the patient's ocular muscle imbalance will result. Better and more complete methods of analysis will insure a more accurate diagnosis and will naturally result in better treatment.

Derrick Vail.

BOOK REVIEWS

OPHTHALMOLOGY, BEING SECTION XII OF EXCERPTA MEDICA. Amsterdam, The Netherlands. Excerpta Medica, Ltd. Price, \$15 per year.

A new abstract journal has been launched whose purpose it is to publish a complete survey of the entire medical literature. This is to be accomplished by 3,000 specialists who work under the supervision of 400 editors. One may subscribe for any number of the 15 sections which are published separately.

The first issue of Section XII, Ophthalmology, has been received. The preface states that completeness is the first objective the editors have set for themselves. Abstracts of articles of any importance will be at least long enough so that the reader may judge for himself whether he wants to refer to the original. When it is impossible to give a detailed abstract, the title will be given to draw the reader's attention to the existence of the original. The second objective is to produce a readable text for those readers who cannot find time to cover the world literature of their specialty in the original.

The coverage seems to be complete. The section on ophthalmology compares favorably with the prewar *Centralblatt*. There are 48 pages of competently written abstracts, all by men of the highest caliber. The abstracts, all in English, are so comprehensive that the general reader is adequately informed, and the investigator of a similar problem can judge whether he needs to consult the original. Not only are the major ophthalmic articles abstracted, but articles of ophthalmic interest are taken from journals which most specialists would not think of combining. Most of the publications abstracted in the first issue appeared in 1946, a few as early as 1940. The preponderance of articles from 1946 justifies the belief that

abstracts will appear rather promptly.

It is perhaps inevitable that the general reader who uses this journal as a substitute for the original literature will find himself exhausted. Such concentrated diet engenders a state comparable to museum fatigue. The material is, after all, a collection of condensations made by many men and presumably not altered by one editor in the interests of unity of viewpoint. It is not the function of an editor to evaluate critically the data presented by the original author, but he can be of tremendous help to the general reader by pointing out, often with the utmost brevity, the significance of data which the original author presents with comments that are only adequate for a fellow-worker but cryptic for the general reader.

F. H. Haessler.

RETINAL STRUCTURE AND COLOUR VISION. By E. N. Willmer, Sc.D. Cambridge, University Press, 1946. 231 pages, 77 illustrations (4 in color), index, and bibliography. Price, \$4.50.

This monograph presents a novel, stimulating, and plausible theory of retinal function. The increasing interest in this little understood field should lead to further research to test its validity and implications. Willmer's thesis, in simplified outline, is this:

The central fovea is dichromatic when precisely tested with 20-minute test objects. The color confusions that result from the relative insensibility to blue are typical of tritanopia. This sensitivity of the fovea to but two color factors simplifies the analysis of the mechanisms involved. The bipolar cells of this area include not only the midget type, characteristic of the direct-cone pathway, but also

flat bipolars, typical of a rod-cone pathway. Hence the deduction: that the fovea has receptors belonging to the rod family of cells, dependent on visual purple for their spectral sensitivity, though incapable of the rapid accumulation of visual purple necessary for dark adaptation. The cone-midget bipolar unit is then the "red receptor," while the "green receptor" is formed by the combined action of cones and nonadapting rods relaying centrally through the flat bipolars.

The perception of blue appears connected with the normal rod-mop bipolar pathway, for in blue light acuity is higher in the retinal periphery than in the fovea. Since light adaptation increases the sensitivity to blue, the light-adapted rod, which has experienced some bleaching of visual purple, may be considered the "blue receptor." This view is supported by the interrelationship of tritanopia and night-blindness, the sensitivity to dim light in tritanopia being about 0.55 percent of normal. A 5-mm. blue disc only appears full blue when the object approaches near enough for the image to involve the parafovea.

Inhibition of the adapting rods by the cones, suggested by the electroretinogram, reduces rod activity during daylight and prevents dazzle. Rod-cone antagonism

may be likened to that of the sympathetic and parasympathetic systems. From the nature of their dendrites and the action of drugs, the cones would seem cholinergic and the rods adrenergic.

When the energy values in the scotopic and photopic visibility curves are related to impulse frequency, the results reasonably explain the characteristics of the color chart, hue steps, and color variations at different light intensities and by addition of white. In this respect the application of Willmer's theory gives significance and coherence to what has hitherto seemed inexplicably bizarre.

In birds, color vision probably depends on three types of cones, but there is no such evidence in man. Willmer's interpretation, though admittedly speculative, has the advantage of being based on what has been already demonstrated in human visual physiology. A possible mission of the Eye Banks could be the further advance of our knowledge in this field by the procurement of eyes of known types of color blindness for the study of their retinal structure and photochemistry by especially qualified investigators—a direct approach, previously unfeasible, that promises much.

James E. Lebensohn.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

1

GENERAL METHODS OF DIAGNOSIS

Jaques, R. The size of the blind spot in aphakic eyes. *Ophthalmologica*, 1947, v. 113, June, pp. 365-374.

The author measured the horizontal and vertical diameter of the blind spot in 27 emmetropic and 29 aphakic eyes. Campimetry with lenses correcting the aphakia proved difficult and unsatisfactory apparently because the strong lenses produced marked and inconsistent distortion of the perimetric findings. The author, therefore, resorted to campimetry without correcting lenses, using a round white fixation target two centimeters in diameter. The size of the blind spot was determined at one meter with a white target one centimeter in diameter, moved from the seeing into the blind area. Under these conditions, the normal blind spot of the aphakic eye proved to be about one-third larger than that of the emmetropic eye. This empirical result tallies with the theoretical one, since the refractive power of the emmetropic eye (58.64D after Gullstrand) is about 1.35 times the re-

fractive power of the aphakic eye (43.05D). Peter C. Kronfeld.

Vaško, A., and Peleska, M. Visual diagnosis of eye diseases by means of infrared radiation. *Brit. Jour. Opth.*, 1947, v. 31, July, pp. 419-421.

In their studies the authors illuminated the eye with infrared radiation of a wave length exceeding 8,500 Å. The image was then projected by means of an objective lens onto the photoelectric cathode of an image converter. This converter transformed the infrared image into a visible image on a fluorescent screen. This image on the screen was then photographed.

Morris Kaplan.

2

THERAPEUTICS AND OPERATIONS

Andrews, G. W. S. Distribution of penicillin in the eye after subconjunctival injection. *Lancet*, 1947, v. 1, May 3, pp. 594-596.

Subconjunctival injections of 50,000 units of pure sodium penicillin were made in the left eyes of four rabbits.

The bleb was absorbed at the end of three hours and the eyeball appeared normal at the end of six hours. The blood serum contained four units per cc. in one half hour and reached zero at the end of two hours. The concentration in the aqueous reached 16 units per cc. in one half hour and fell to one unit per cc. at the end of four hours. The cornea contained 170 units per cc. one half hour after the injection and fell to 1.7 units per cc. at the end of four hours. The levels in the optic nerve were high, but fell rapidly. The uninjected fellow eye had a similar distribution, but with lower levels of concentration. Irwin E. Gaynon.

Angius, T. and Mojne, G. Plesiotherapy (contact radiation) in ophthalmology. *Rassegna Ital. d'Ottal.*, 1947, v. 16, March-April, pp. 107-130.

The authors report upon 91 cases of various pathological conditions of the eye, especially corneal disease, treated by contact doses of roentgen radiation. Small doses were especially effective in herpes of the cornea and subacute, torpid keratitis with decreased corneal sensitivity. The treatment should be applied as early as possible and dosage should never exceed 400 r. The treatment is interrupted as soon as improvement is observed, even after one application, lest re-activation of the disease should occur. Eugene M. Blake.

Apple, Carl. Instruments for use in ophthalmic surgical procedures. *Arch. of Ophth.*, 1947, v. 37, May, p. 652.

The author's corneal scissors are a modification of the Walker scissors. The lower tip extends 1 mm. beyond the upper tip; the extended part is 1 mm. wide; the extreme end is rounded, and the surface is highly polished. This enables the operator to

enter the anterior chamber with less difficulty and without trauma to the iris after the original section of the cornea.

In the iris redepositor described, the handle may be rounded or square; the round handle enables the operator to rotate it between the thumb and the index finger. The redepositor portion is bent at an angle of 115 degrees and is 5 mm. long and 2 mm. wide; the extreme end is rounded and dull, and the surface is highly polished. (2 figures.) R. W. Danielson.

Bellows, J. C., Burkholder, M. M., and Farmer, C. J. Streptomycin in experimental ocular infections. *Proc. Soc. Exper. Biol. and Med.*, 1947, v. 65, May pp. 17-18.

On rabbits anesthetized with intravenous injection of nembutal the penetrability of streptomycin through the cornea is increased by abrasion, inflammation, ion transfer and wetting agents. No local toxic effects were noted when saline solutions of streptomycin containing 10,000 ug per cc., were used. Concentrations of 50,000 ug or the dry powder caused delayed healing. Intraocular injections of 1,000 ug in 0.1 cc. saline solution were well tolerated. Concentrations of 25 to 300 ug were therapeutically effective (up to 6 to 8 hours) against a virulent strain of *Streptococcus pyogenes*. Corneal ulcers were prevented in *Bacillus pyocyaneus* infection by three applications at two-hour intervals of a saline solution containing 10,000 ug of streptomycin per cc. H. C. Weinberg.

Benedict, W. L., and Henderson, J. W. Sodium sulfacetimide. *Amer. Jour. Ophth.*, 1947, v. 30, August, pp. 984-986. (9 references.)

Bonazzi, A. Surface anesthesia with Farmocaine. *Rassegna Ital. d'Ottal.*, 1947, v. 16, May-June, pp. 224-227.

Farmocaine is a new surface anesthetic presented by the firm of Farmitalia. Employed in solutions varying in strength from one-fourth to 2 percent the drug produces rapid anesthesia, with no effect upon the intraocular pressure, pupillary diameter, or the epithelium. It is of low toxicity and boiling it for 10 minutes at 100 degrees C. does not destroy its action.

Eugene M. Blake.

Esente, Ivan. First therapeutic experiments with paraaminobenzoildithethylaminoethanol chloride (Recor-cain) used intravenously in ocular diseases. *Riv. di Oftalm.*, 1946, v. 1, Nov.-Dec., pp. 671-678.

Recoraine was first used in 1941 by Dos Ghali, Bourdin and Guiot. One percent solutions were given intravenously in asthma, pulmonary embolism, and angina syndromes, dyspnea of emphysema, and tuberculosis. With and without additional atropine administration, the drug proved to be useful in gastric neuroses and gastric ulcers, it was used in carbon monoxide poisoning and in hyperthermic coma. The drug acts as a depressor of the respiratory center which, with higher dosage, may become paralyzed. Muscular contractions become rarer, the action on peripheral nerve centers is inhibitory. An antihistaminic action was ascribed to the drug by State and Wangenstein, 1946. Through the vegetative centers the drug produces a transient heat sensation and slight drowsiness, or sleep. Ocular pain and headache are relieved for shorter or longer periods. Lutton, Roumer, Giraud and Ferran were able to combat eclamptic amaurosis by intravenous administration of recoraine.

Esente used it in painful glaucomas, where the results mostly were satisfactory (no statistics). Pain was relieved and intraocular pressure was reduced for much longer than the time during which the drug was administered. Simultaneous use of miotics may enhance these effects. The doses given varied between 10 and 100 centigrams.

K. W. Ascher.

Filatov, V. P. Problems of tissue therapy. *Oftal. Jour. (Odessa)*, 1946, pt. 3, pp. 1-6.

The experience and research with tissue therapy during the war eliminated the chief objection to this method of therapy, that is, the lack of sterility in transplanted tissue. It was found that the therapeutic effect of tissues preserved on ice is not diminished by boiling, and by autoclaving at 120 degrees for one hour. This fact was demonstrated experimentally by Skorodinskaja and Tarasova in restoring skin defects on white mice, and clinically in such diseases as myopic chorioretinitis, uveitis, and trachomatous pannus. Inasmuch as in boiled extracts albumens are present only in insignificant amounts, heterogeneous tissues may be used without fear of anaphylactic reactions. The effectiveness of extracts of green leaves, preserved in darkness, further simplified this form of therapy in making possible their administration orally or by rectum. The value of this form of therapy has been demonstrated in hundreds of cases of trachoma, where it was used in combination with repeated expression. Tuberculous, parenchymatous, herpetic, and trachomatous keratitis react to this therapy very well. It is of value in traumatic uveitis and vitreous opacities. It constitutes the chief therapy in retinitis pig-

mentosa. It is useful in all types of optic atrophy, and in glaucoma. An incidental effect is the improved function of the uninvolved eye. It has proved valuable in a number of general diseases such as experimental tuberculosis in animals, lupus, scleroderma, neuritis, neurodermatitis, and post-traumatic contractures and limitation of movement. During the war this therapy was used and found effective in ulcers of the stomach, in lesions of the peripheral nervous system, in epilepsy, in typhus, brucellosis, pellagra, and leprosy. On the basis of experimental and clinical investigations the following hypothesis is presented. Tissues separated from the organism and subjected to an atmosphere unfavorable to life undergo biochemical changes; as a result of these changes they produce substances which stimulate the biological processes. These substances, when introduced into an organism, act as stimulants of its biologic processes; they stimulate cellular metabolism, and thus physiologic functions; in case of disease they augment the organism's regenerative powers and resistance to disease. Biogenic stimulants, products of biochemical changes, arise also in organisms placed in environments which make life difficult, but not impossible; such a reaction may play a role in the process of evolution. The crisis in acute infections is an example of unfavorable conditions leading to biochemical changes with the development of stimulants. Conditions leading to the development of biogenic stimulants are varied; preservation of animal tissues on ice, preservation of plants in darkness, the action of ultraviolet light, exposures to X ray and fever therapy. Biogenic stimulants are the products not of the dead cell, but of the living cell fighting for

life. It has been shown in botany that traumatized cells produce traumatic acid, belonging to the dicarbon group. It is possible that the biogenic stimulants are of a similar nature. Since they tolerate a high temperature they could not be albumens or ferments. This hypothesis may explain the beneficial effect of mud therapy, which Filatov believes is due to the biogenic stimulants accumulated in the mud by the living substances which took part in its formation. Autoclaved extracts of seashore mud prepared at the Institute produced effects similar to those of tissue extracts. Agricultural experiments have shown that preliminary processing of seeds of corn, wheat, and oats with extracts of preserved tissues hastens their sprouting, ripening, and productiveness. Ray K. Daily.

Haffly, G. N., and Jensen, C. D. F. Method for the maintenance of sterility of ophthalmic solutions. *Arch. of Ophth.*, 1947, v. 37, May, pp. 649-650.

The authors use 20-cc. rubber-capped vaccine bottles for their ophthalmic solutions. The rubber cork is painted with zephiran chloride before each removal of solution with a syringe and needle.

R. W. Danielson.

Halbron, P., and Aitoff, H. Nylon thread in ocular surgery. *Ann. d'Ocul.*, 1947, v. 180, March, pp. 158-167.

The relative advantages of absorbable and nonabsorbable sutures are discussed in detail. Ocular sutures should be resistant, easily manipulated, have a smooth surface, should not swell, should not produce inflammatory reactions and should be easily sterilized. The form of nylon currently used for suture material is polyheamethylene adipamide. It has a density of about

1.5, a refractive index of 1.55, its molecular weight varies between 10,000 and 20,000, it is not affected by ordinary temperatures or the usual solvents, equally resists alkalis and diluted acids, and has a resistance to traction which is superior to silk. Multibrin, a braided nylon, is more supple, is more adequately knotted and has an elasticity superior to natural silk. Nylon sutures are better tolerated by the tissues than silk; no reaction has been observed after three weeks. The sizes usually employed are 0.1-mm, 0.15-mm, 0.2-mm. Sterilization may be accomplished by wet heat or dry. In cataract extractions a 0.15-mm. thread is used in the superior rectus for fixation, and in conjunctival and corneo-scleral suturing. Knots should be firmly tied because the material is slightly elastic. Corneo-scleral sutures fall out about the tenth day. In muscle operations the 0.15-mm. or 0.2-mm. sizes are used and should not be cut too short. In eviscerations, or retinal detachments the 0.15-mm. sizes may be used. In skin sutures, nylon is of special value because of its size and because it slides easily in the tissues. (13 references.)

Chas. A. Bahn.

Owens, E. U., and Woods, A. C. The use of furmethide in comparison with picocarpine and eserine for the treatment of glaucoma. *Amer. Jour. Ophth.*, 1947, v. 30, August, pp. 995-996. (1 table, 2 references.)

Palomino Dena, Feliciano. Problems and recent advances in ocular surgery. *Anales de la Soc. Mexicana de Oft.*, 1947, v. 21, April-June, pp. 88-107.

This is a brief review of a number of recent papers on ocular surgery, including the subjects of pterygium, corneal transplant, intracapsular cataract oper-

ation, retinal detachment, and other details. (Bibliography.)

W. H. Crisp.

Puglisi-Duranti, G. Vaccine-therapy (spirochetic vaccine of Hilgermann) in some cases of ocular syphilis. *Boll. d'Ocul.*, 1946, v. 25, July-Sept., pp. 407-420.

Hilgermann vaccine is prepared from strains of nonvirulent polyvalent spirochetes and is used together with chemotherapy to secure sterilization of the system and to prevent the late nervous manifestations. The writer treated seven patients, two of whom had anterior uveitis, four optic neuritis, and one total paralysis of the third cranial nerve, with varying degrees of success. The treatment is to be tried in neurophthalmic syphilis which very frequently is a forerunner or concomitant of grave forms of neurosyphilis.

Melchior Lombardo.

Quilliam, J. P. Di-isopropylfluorophosphonate (DFP); its pharmacology and its therapeutic uses in glaucoma and myasthenia gravis. *Post-Grad. M. J.*, 1947, v. 23, June, pp. 280-282.

Aqueous solutions of DFP are unstable because of hydrolysis. DFP combines irreversibly with choline esterase. Choline esterase activity is restored when the enzyme protein is resynthesized. Peanut oil is used as a vehicle. In the normal eye DFP may cause miosis that lasts three weeks with ciliary spasm for three to seven days. It overcomes atropine easily. In glaucomatous eyes, a 0.1 percent solution, is effective for 12 hours. A 0.1 percent solution of DFP is as effective as 1 percent esserine. Irwin E. Gaynon.

Schubert, Franz. The effect of iodine baths on diseases of the eye. *Wiener*

Klin. Wchnschr., 1947, v. 59, July 4, pp. 435-436.

The author who practices in Bad Hall, Austria, reports his favorable experiences in treating certain eye diseases of patients who took the cure in this community which harbors springs containing iodine. Tuberculous inflammations like keratoconjunctivitis ex-cematosa and chronic tuberculous iritis showed marked improvement. The progress of chorioretinitic lesions could be stopped with subsequent improvement of the visual acuity. The bath-cure hastens the absorption of vitreous opacities, especially those caused by hemorrhages. The large group of arteriosclerotic diseases which lead to retinal hemorrhages and to retinal degeneration responds favorably to an extensive iodine cure. So do cases of partial venous thrombosis. Interstitial luetic keratitis improved under the treatment. The article emphasizes the necessity of repeated annual visits. It is not made clear how the water is administered nor how it is believed to act.

Max Hirschfelder.

Thomas, G. J., and McCaslin, M. F. Pentothal sodium in ophthalmic surgery. Arch. of Ophth., 1947, v. 37, April, pp. 452-458.

Pentothal sodium by intravenous injection is an important anesthetic for ophthalmic surgery. The administration is simple, the induction is short and pleasant, the depth of narcosis is controllable, the operative field is free of the anesthetist and his equipment and the intraocular tension is reduced 40 to 60 percent.

Pre-anesthetic medication consists of the administration of morphine and atropine and the local use of cocaine. The technique of administration and the complications are discussed. Pento-

thal sodium should not be employed if there is pronounced interference with the respiratory function, if there is bronchiectasis, severe anemia or shock and its use is not advisable in children under seven or eight years of age. The drug should be administered by a thoroughly trained anesthetist, who is competent to deal with any situation that may occur. John C. Long.

Vidal, F., Brodsky, M., and Travi, O. C. Miosis due to carbaminoylcholine in patients with retinal angiosclerosis. Arch. de Oft. de Buenos Aires, 1946, v. 21, Oct.-Nov., p. 350.

In 31 cases of retinal angiosclerosis the instillation over the corneal limbus of one drop of a 0.33 percent solution of carbaminoylcholine chloride produced a miosis. It began in about five minutes as in normal individuals but reached its maximum in 30 minutes and lasted longer than in normal eyes. (Bibliography.) Plinio Montalván.

Vidal, F., and Villa, E. Practical modifications of the Schiötz tonometer. Arch. de Oft. de Buenos Aires, 1946, v. 21, Oct.-Nov., p. 313.

The authors modified the Schiötz tonometer by substituting two threaded bolts for the screw that holds the disc of the plunger, painting red and black the markings of the scale, and attaching two cupped discs for the fingers when holding the instrument. (Illustrations and bibliography.)

Plinio Montalván.

Vidal, F., and Zappi, D. A. Imperfections of tonometers of the Schiötz model. Arch. de Oft. de Buenos Aires, 1946, v. 21, Oct.-Nov., p. 325.

Fourteen Schiötz tonometers of Austrian, American, French, German and Swedish manufacture were tested

with a modified torsion scale and all of them were found to be inaccurate. (Bibliography.) Plinio Montalván.

Vouters, J. Basal scopolamine-morphine-ephedrine anesthesia in ophthalmology. *Ann. d'Ocul.*, 1947, v. 180, March, pp. 149-157.

S-M-E anesthesia is recommended in major ophthalmic operations in nervous patients especially if immobility of the eye is important, as in glaucoma and cataract surgery, and in infants. It is useful in some enucleations, eviscerations, and operations for intraocular foreign body, in operations of long duration such as retinal detachments, lid plastics, orbital exenteration, and in dacryocystorhinostomy.

One hour before operation two cc. of a French proprietary drug called Nargenol is injected subcutaneously. This solution contains dihydroösycodeinone 2.00, scopolamine camphosulfonate .0005 ephedrine camphosulfonate .002, spartine .005, and physiological salt solution q.s. ad. 2.00. In infants, one fifth cc. is injected and in a child of five years, one cc. is used. The advantages of this type of anesthesia are that it leaves a clear field for surgery, the period of anesthesia is reduced and there is no agitation nor vomiting. Occasionally slight respiratory irregularity may appear 45 minutes after injection, which can be overcome by caffeine or lobeliene. Under certain conditions the anesthetic solution may be increased to four cc. without danger. Barbiturates and bromides tend to accentuate its effect. Chas. A. Bahn.

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Albada, L. E. W. Construction of the paraxial images and the path of a ray

through an optical system. *Acta. Ophth.*, 1947, v. 25, pt. 1, pp. 1-8.

This is a mathematical demonstration. (7 geometric figures.)

Ray K. Daily.

Arjona, J., Stenopeic hole and its use. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, May, pp. 425-435.

The stenopeic hole has a number of uses in ophthalmology, some of which are practical and others experimental. Its principal clinical use is to distinguish between the low vision of a refractive error and disturbances of the transparent media, retina or optic pathway. The basis of its action is a reduction to a minimum of the circles of diffusion on the retina. These circles are larger the higher the degree of ametropia. The stenopeic hole may be used as a loupe for viewing near objects for the same reason. To avoid movements of the eye the hole is used after operations for retinal detachment. Its use has been recommended for albinos.

It also has experimental uses. In Mile's experiment, when a distant light is seen through the stenopeic hole, which is moved forward to the anterior focal plane, one of three things may occur. The light remains fixed, it moves in the same direction as the hole, or in the opposite direction. In the first case the eye is emmetropic, myopic in the second and hypermetropic in the third. This experiment was the basis of the kinescopy, wherein the movement of the light is neutralized by means of lenses. In Scheiner's experiment two stenopeic holes are placed horizontally in a screen less than a pupillary diameter apart. When a pin is viewed through the two holes while the eye fixates a nearer object the pin is seen

double and diplopia is direct. When the eye fixates a more distant object diplopia is crossed. This experiment proves the existence of accommodation and is used to measure its amplitude. Several diagrams are shown for the better understanding of these experiments.

J. Wesley McKinney.

Burian, H. M. The place of peripheral fusion in orthoptics. *Amer. Jour. Ophth.* 1947, v. 30, August, pp. 1005-1010. (3 references.)

Burian, H. M. Sensorial retinal relationship in concomitant strabismus. *Arch. of Ophth.*, 1947, v. 37, May, pp. 618-648.

In this portion of a paper too long to print in one issue of the Archives, the author discusses the origin, literature and nomenclature of anomalous correspondence. This is an excellent paper for those who are interested in this subject and already understand some of the fundamentals. Any abstract would be inadequate. (106 references, 9 figures, 2 tables.) R. W. Danielson.

Carreras Matas, B. A concept of the degree of myopia and hypermetropia in an astigmatic eye. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, April, pp. 348-350.

As a formula for the measure of myopia or hyperopia of an astigmatic eye Matas uses the sum of the diopters of sphere and half the diopters of astigmatism. He demonstrates the mathematical derivation of this formula.

Ray K. Daily.

Gallagher, J. R., Ludvigh, E. J., and Martin, S. F., and Gallagher, C. D. Effect of training methods on color

vision. *Arch. of Ophth.*, 1947, v. 37, May, pp. 572-582.

In various surveys it has been found that from six to eight percent of unselected males are unable to make the proper responses to a series of color vision test plates. Regardless of the reliability of various testing methods or the desirability of altering present standards, there still remains the problem whether the color vision of those who fail to pass these tests can be modified. Whenever large numbers of persons are excluded either from a branch of the armed services or from a civilian occupation because of a physical disability, there will develop a demand from those affected that the disability be remedied or that the standards applying to it be lowered. In the problem at hand, the rejection of many otherwise well-qualified men has led to efforts to improve the color vision of these rejectees so that subsequently they might be able to pass the color vision tests. In an effort to determine the effect of training methods, a group of subjects previously identified as being deficient in color vision was studied.

Forty-nine subjects who had been selected as weak in color vision on the basis of responses to the American Optical Company pseudo-isochromatic test plates were subsequently given training on those test plates until all but 4 could satisfactorily pass that particular color vision test. However, only 6 made perfect responses to all the plates in the very similar Ishihara test, and the scores on a color desaturation test, which also had not been practiced, did not improve. A retest on the American Optical Company plates several months later showed a considerable diminution in ability to make correct responses to these plates and indicated

that the effects of this type of training may not long persist.

Color vision training apparently is successful in enabling most persons with weak color vision to respond correctly to such a test as the American Optical Company plates or the desaturation test herein described, but from this study there is no evidence that either of the training methods used improved the capacity to discriminate between colors in a situation other than the one in which training was given. (6 tables, 2 figures, 6 references.)

R. W. Danielson.

Gát, L. A new subjective test for astigmatism. *Ophthalmologica*, 1947, v. 113, Feb., pp. 93-105.

A dial test for astigmatism has been combined with Scheiner's double pinhole test for ametropia. The dial recommended by the author consists of a heavy, black, double cross, the strokes of which are two centimeters wide and placed two centimeters apart. In the center the strokes are interrupted except for four black squares (two centimeters square) at the actual crossing places of the horizontal and vertical strokes. These central squares apparently facilitate the observation of the various distortion phenomena due to astigmatism. The dial can be rotated around the axis laid through the center of the cross. It is viewed through a double pinhole (1-mm. holes, placed 2.5 mm. apart). Ametropia causes diplopia which, because of the construction of the dial, is easily noticed and described. The author stresses the accuracy of the method. "It is possible to find axis divergence of 2° and astigmatic ametropia of 0.25D." The test requires "comparatively little intelligence and power of observation."

Peter C. Kronfeld.

Giudice, Mario del. Ocular allergy. *Rev. Brasileira de Oft.*, 1947, v. 5, June, pp. 209-218.

In various parts of Brazil, where the tree is native, and also in India, where it is cultivated, the natives make a household remedy for infestation by lice by grinding the seeds of the first of one of the anonaceae, *Rollinia sylvatica*, and mixing it with pork fat. The mixture is rubbed into the hairy scalp and the hair is subsequently washed with soap and water. The author reports several cases of allergic reaction in the eyelids and conjunctiva, with abundant tearing, slight mucous secretion, intense photophobia, burning, and itching. Alleviation may be obtained from instillation of adrenalin solution. (One illustration, references.)

W. H. Crisp.

Hartmann, E. The psychology of vision. *Ann. d'Ocul.*, 1947, v. 180, April, pp. 193-205.

Hartmann presents a brief but comprehensive analysis of the mental aspects of the process of vision. We seldom see what we think we see. Retinal images differ greatly from visual interpretations. The latter are composed of our proprioceptive stimuli, intellectual concepts, past experience, and hereditary factors. One may ignore or eliminate parts of the pattern of visual perception, as is done by one with strabismus or in using the microscope. We may add to our visual perceptions as in viewing cartoons. Personalities such as Li'l Abner or Jiggs, are in reality only a few printed strokes and devoid of detail.

In the perception of colors our sense of values is modified by the surroundings of the object perceived. Psychologically, we associate colors in an orthodox manner. We know that violet

is a red-blue but we do not realize red as violet-orange. The same is true of complementary colors. We also associate color values with emotional values. Red suggests the rich, sumptuous, or gay; violet, the majestic; black, sadness; certain greens, outdoor life. The association of red with heat or warmth, blue with cold, is used in the color schemes of homes and factories.

In the concept of form, visual interpretation plays an important part. In the steps of Schroeder or the cube of Necker the third dimension of depth, which does not exist on the retina, is added by our imagination. Knowing that money is round, our consciousness does not register the many ellipses that are actually formed when discs are viewed at different angles.

Our interpretation of direction depends on numerous factors. The actual retinal image, our visual fields as related to parts of our body, as well as our proprioceptive sensations which emanate from the muscles of our eyes, neck and trunk, all enter into this complex visual function.

In estimating the size of objects we are guided by the macular and peripheral image sensation, combined with angulation. A small object in the sky may be first recognized as an airplane but soon it is known to be a gull.

The estimation of distance involves not only our central and peripheral retinal visual sensation, but also our judgment gained through past experience, and color differences such as zones of shadow or the bluish color of the air. Paralactic displacement and linear perspective also enter into this complex mental process. After years of blindness those who have regained sight have at first a very poor sense of distance.

Reversal of the inverted picture on

the retina does not actually exist as the visual perceptions involved are really reversed in the calcarine region. Rapidly moving objects when photographed show a blurred course which does not exist in vision. Binocular single vision is obtained by merging the two retinal images to give the inference of depth. If the monocular components are identical, the binocular perception does not differ from the two components. If slightly different, the binocular perception is intermediate; but if the monocular components differ too widely, binocular perception is impossible, and one of the images is either neutralized, or both images strive for supremacy. In the stereoscope a false conception of depth is obtained by viewing two slightly dissimilar images through convex prisms, base in, which relaxes the accommodation and convergence. In reading, the adept does not recognize letters, or even words, individually but assembles them into groups, five or six to the line.

Chas. A. Bahn.

Mata, Pedro. A Case of erythropsia. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, May, pp. 436-441.

For about two weeks a boy, 10 years old, had noticed that everything became red for about a minute several times a day. During the attack the patient closed the eyes so strongly that a marked blepharospasm was produced. The vision, fundus, and visual fields were normal. All the laboratory tests were negative. The erythropsia was attributed to vascular spasm of the Sylvian and posterior cerebral arteries, which produced irritative hallucinations of the optic pathway or cerebral cortex.

J. Wesley McKinney.

Miles, P. W. Clinic for binocular problems. *Amer. Jour. Ophth.*, 1947, v. 30, Sept., pp. 1169-1171.

Pascal, J. I. Ophthalmic calculations by the "dam" method. *Brit. Jour. Ophth.*, 1947, v. 31, July, pp. 424-426.

Mathematical formulas for the calculation of lens surface power of all thin and of most thick lenses are briefly presented. The "dam formula is the general formula for surface power and is properly written as $D = \frac{A}{M}$. D is the power in diopters, A is the difference between the index of refraction of the second medium and the first, and M is the curvature in metrecs. (A metrec is the unit of curvature and is the ratio of lens power expressed in its focal length and its radius of curvature). Thus, to estimate the power of the anterior surface of a cornea having a radius of 8 mm. and an index of 1.376 the formula is applied: $D = \frac{1.376 - 1}{8 \text{ mm.}}$

$$1 = 0.376) \times \frac{1000 \text{ mm.}}{8 \text{ mm.}} = 47. \text{ Or to}$$

estimate the D of the posterior surface of a cornea having a radius of 6.8 and the index of the aqueous is 1.336: $D = \frac{1.336 - 1.376}{6.8}$

$$1.336 - 1.376 \times \frac{1000}{6.8} = -5.88. \text{ The}$$

same formula applies to contact lenses and also to thick spectacle lenses where the sum of the powers of the two surfaces becomes the power of the lens.

Morris Kaplan.

Pfister, A. A chart for the objective determination of the visual acuity. *Ophthalmologica*, 1947, v. 113, June, pp. 344-364.

For a number of years H. Goldmann (*Ophthalmologica*, 105:240, 1943) and Pfister have been engaged in studies of the optokinetic nystagmus as a means of estimating the true visual acuity (the minimum separabile) in malingerers. Pfister now describes the many "complications" encountered and the final

method evolved as the result of those complications. The cessation of the optokinetic nystagmus upon reduction of the nystagmus-eliciting pattern below the minimum separabile is the principle of the method. The moment of cessation of the nystagmus is determined by observation of a large episcleral vessel with the ophthalmoscope and a +10D lens. The examinee who is given no information concerning the nature of the test, is asked to look at a checkerboard, black and white pattern, which describes rhythmic up and down movements against a gray background. If the movements of the pattern elicit a definite vertical pendulum nystagmus, the moving checkerboard is moved farther away from the examinee until the nystagmus stops. The refractive error must be accurately corrected with glasses. The observation with the ophthalmoscope must be conducted in such a way that no light falls into the pupil and that there is no interference with the patient's viewing the chart. The aphakic eye does not lend itself to this test because of its low depth of focus. In a few perfectly normal, emmetropic (non-malingerers) individuals the nystagmus could not be elicited. There is surprisingly good correlation between the subjective and the objective visual acuity in patients who admit their true acuity.

Peter C. Kronfeld.

Pignatosa, G. Three cases of spasm of accommodation during lactation. *Boll. d'Ocul.*, 1946, v. 25, July-Sept., pp. 415-420.

Three cases of visual disturbances in lactating women are reported in detail. General and local treatment cured the condition in a short time. The writer reviews the literature. He found that no case has been reported in which spasm

was dependent on lactation. The writer believes that in his patients anemia and a nervous depressive state were predisposing causes aggravated by the debilitating effect of lactation. (Bibliography.) Melchior Lombardo.

Rios Sasiain, Manuel. Some advances in physiologic optics. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, April, pp. 351-359.

The author reviews the newer investigations on accommodation, nocturnal myopia, double function of the retina, Purkinje's phenomenon, electroretinography, and visual substances, such as visual purple, visual yellow, and the visual cone substance.

Ray K. Daily.

Rosso, S. The estrogens and accommodation. *Rassegna Ital. d'Ottal.*, 1947, v. 16, March-April, pp. 98-106.

Rosso shows by case reports that estrogens employed in the treatment of female genital disturbances lead to a diminution of accommodation. The effect is apparently due to a disturbance of the neuro-vegetative system.

Eugene M. Blake.

Safar, K. Chalazion and astigmatism. *Wien. Klin. Wchnschr.*, 1947, v. 58, July 25, pp. 484.

The fact that chalazion in the upper lid may be a cause of considerable astigmatism does not seem to be well known, at least it is not mentioned in the *Kurzes Handbuch*. To call attention to its occurrence the author reports an astigmatism of 1 D. that was caused by chalazion. (4 references.)

F. H. Haessler.

Schmidtke, R. L. Wetting agents for contact lenses. *Amer. Jour. Ophth.*, 1947, v. 30, August, pp. 1013-1014.

Sebas, S. R. Considerations as to astigmatism. *Rev. Brasileira de Oft.*, 1947, v. 5, June, pp. 221-229.

The author lays great stress on the measurement of corneal astigmatism with the ophthalmometer. He has frequently found it necessary to make separate astigmatic measurements for distant and near vision. W. H. Crisp.

Sloane, A. E. Refraction clinic. *Amer. Jour. Ophth.*, 1947, v. 30, August, pp. 1014-1016. (1 figure.)

Thomson, L. C. Binocular summation within the nervous pathways on the pupillary light reflex. *J. Physiol.*, 1947, v. 106, March 15, pp. 59-65.

It has been shown that the degree of constriction of the pupil which results from the stimulation by light of the retina of a single eye was significantly less than that obtained when both eyes were stimulated.

This binocular summation was equivalent to that obtained by increasing the area of the stimulating flash between two and four times and observing with a single eye throughout.

This binocular summation does not appear to be influenced by cerebral cortical activity. The position of the summation within the nervous pathways is discussed.

Theodore M. Shapira.

Tirelli, G. High hypermetropia. *Rassegna Ital. d'Ottal.*, 1947, v. 16, March-April, pp. 85-92.

Tirelli reviews the literature concerning high degrees of hypermetropia and reports the case of a six-year-old boy who had 16 diopters in the right eye and 17 in the left. The partially corrected vision was 2/10 in the right and 1/10 in the left eye. Ophthalmoscopically the only changes observed were

pseudo-neuritis and slight tortuosity of the retinal vessels. Eugene M. Blake.

Wald, George. **The chemical evolution of vision**, The Harvey Lectures, 1945-1946, Series 41, pp. 117-160.

The chemical evolution of vision is traced by the use of the knowledge that carotenoids play a major part in photoreception in plants and animals. The light stimulus, which causes molds and higher plants to bend and show other orientation, is absorbed by carotenes and xanthophylls. These pigments with another carotenoid astaxanthin, are found at the eye spots of certain green flagellates.

Arthropods and molluscs have image forming eyes but cannot synthesize carotenoids, and photoreception is dependent upon vitamin A₁ and retinene₁. Fresh water vertebrates (or animals that spawn in fresh water) have the porphyropsin system of the rods based on vitamin A₂ and retinene₂.

Euryhaline fish (which as adults can tolerate fresh water or salt water) possess both the rhodopsin and porphyropsin systems. The amphibia also have both the rhodopsin and porphyropsin systems. The bullfrog during metamorphosis transfers from the porphyropsin to the rhodopsin system.

Iodopsin is found in vertebrate cones. It is a carotenoid-protein closely related to the rod photopigments. From the human macula a pigment xanthophyll has been isolated, showing that human foveal vision depends on an intact carotenoid. (13 figures.) H. C. Weinberg.

4

OCULAR MOVEMENTS

Anderson, J. Ringland. **Ocular vertical deviations**. Brit. Jour. Ophth., 1947, Monograph Supplement XII.

This monograph presents a study of vertically-acting ocular muscles and includes statistics on a series of 402 patients with horizontal and vertical defects of concomitant and paralytic types. The literature is reviewed. Methods of complete examination are fully described. It is emphasized that the coordinated movements of the eyes, and the compensatory movements of the head must be carefully studied. Only an exact diagnosis with accurate interpretation can lead to the correct treatment.

For the measurement of diplopia and the primary and secondary deviations the screen test is recommended. Anomalies of the vertical rotators, especially the inferior oblique are found more frequently than is usually recognized. In concomitant convergent strabismus an overacting inferior oblique muscle was present in over 30 percent, and in an additional 25 percent, paresis of at least one superior muscle was present. Combined with the horizontal defects these figures show that there are few cases of simple concomitant strabismus.

The vertical range of fusion is small and both poorly controlled and little used; thus a small vertical error readily becomes a tropia. Examination usually reveals a paresis or overaction in a vertical imbalance. It is important to distinguish between primary overactions and secondary overactions in vertical rotator pareses. Palsies of the vertical rotators are complete in that there is no response to cortical, subcortical, vestibular or other stimuli. In supranuclear ocular palsies the fibers are often affected by disease as they pass through the brain stem.

Frequent causes of ocular paresis are twilight sleep, obstetrical forceps, and

motor vehicle accidents. Recovery is the rule, although it is somewhat less for vertical than for horizontal palsies. Orthoptic training may play an important part in the treatment.

In the surgical treatment of vertical disorders three principles of correction are considered. These are the strengthening of the paretic muscle, weakening of the overacting contralateral synergist, and weakening the contracture of the ipsilateral antagonist. Vertical defects associated with concomitant strabismus may decrease or cease after the horizontal deviation has been corrected.

The author voices a need for the reporting of the results of exact findings in large series of cases to remove contradictory opinions from the literature. (37 illustrations.) O. H. Ellis.

Dering, S. A. Post-contusion ophthalmohyperkinesis. *Oftal. Jour.* (Odessa), 1946, pt. 3, pp. 40-42.

In some patients with a history of brain contusion Dering noticed a pronounced convergence, without other visual disturbances, which lasted during the period of examination, and disappeared as the examination was concluded. Two patients had a spasm of convergence, which produced a myopia of four diopters in one eye, and eight in the other, associated with transitory spasm of convergence and blephrospasm. The neurologic diagnosis in these two cases was chronic post-traumatic encephalitis, with muscle spasm. Persistent blephrospasm was another symptom frequently encountered in this group of patients. These symptoms are attributed to an irritation of the nuclei of the third nerve in the floor of the aqueduct of Sylvius, producing an involuntary, abnormal

tonic or clonic contraction of the innervated muscles. Ray K. Daily.

Fink, W. H. Anatomical variations in the attachment of the oblique muscles of the eyeball. *Trans. Amer. Acad. Ophth.*, 1947, May-June, pp. 500-513.

Surgery of the oblique muscles is the least understood and least standardized portion of ocular muscle surgery. This is partly due to normal and abnormal variation of insertion and size of the oblique muscle tendons. In this study of 100 specimens, variations, especially of the tendon, are described in detail. The inferior oblique shows greater anatomical uniformity than the superior oblique. Pareses, contractions and spasms of these muscles are frequently confused with anatomical variations. It is important to note the closer nasal insertion of the superior rectus in reattaching it in surgery involving the underlying superior oblique. As an anatomical landmark the overlying superior rectus tendon is preferable to the trochlear process of the superior oblique. Variations in the fascial sheath which connects the inferior oblique and the inferior rectus (ligament of Lockwood) frequently determine the results of oblique muscular surgery. The inferior oblique is best operated upon at its insertion rather than at its bony origin. The posterior edge of the insertion of the inferior oblique extends to within two millimeters of the optic nerve; as it is usually muscular and has a very short tendon, and it should be severed as close as possible to the eyeball. In the reattachment of severed muscles two sutures rather than one should be used to create as broad a line of contact as possible, and the direction of muscle fibers should not be altered.

In high myopia the position of the inferior oblique is more posterior.

Chas. A. Bahn.

Heinonen, Oscar. Birth injury as a cause of strabismus. *Acta Ophth.*, 1947, v. 25, pt. 1, pp. 19-28.

The investigation was based on the study of 84 cases of strabismus, in patients whose parturition histories were available in the hospital where they were born, 75 cases in patients whose histories were obtained from their parents, and 29 cases from an institution for feeble-minded. This material is analyzed with reference to the weight at birth, abnormal fetal positions, surgical procedures for delivery, prolonged parturition, the number of first-born infants and of twins, frequency of feeble-mindedness, symptoms of trauma in the newborn, and diseases of childhood. Because of the great mortality of infants with severe birth trauma or born prematurely a history of these facts is encountered in only about 10 percent of patients with strabismus. The author has the general impression however that mild birth injuries are an important factor in the etiology of strabismus, and that a history of strabismus in the family and of a difficult parturition are frequently encountered together. It is probable that birth trauma is the exogenous factor that is effective in the presence of the hereditary factor, as in other cerebral lesions. Two brief histories of strabismus in twins are reported, to illustrate the two etiological types of strabismus. In one pair of twins with intermittent strabismus, hyperopia and astigmatism, there was a history of strabismus in the family, and of a prolonged spontaneous parturition. Here the etiology is considered chiefly endogenous. The other twins had con-

vergent strabismus with emmetropia, a history of a difficult parturition, but no family history of strabismus; here the strabismus is attributed to the birth trauma.

Ray K. Daily.

Henderson, J. W. Optokinetic and other factors modifying vestibular nystagmus. *Arch. of Ophth.* 1947, v. 37, April, pp. 459-471.

Vestibular postrotational nystagmus is capable of modification by optokinetic nystagmus. In most cases postrotational response is abolished by repeated daily rotation. This suggests that cortical influences are dominant over those of the vestibular level. There appears to be a poststimulus persistence of optokinetic rotational nystagmus which is effective in reducing postrotational response.

Variability of response has been shown to be the expected finding in the higher forms which possess a well-differentiated cerebral cortex. This tends to render less valid work which has been done in lower species whose response is mainly reflex in type. This also supports the accumulating mass of evidence which invalidates the Bárány test as a precise diagnostic aid.

John C. Long.

Joly, J. P. Considerations on the "myocampter." Hypocorrection and hypercorrection in strabismus. *Arch. d'Ophth.*, 1947, v. 7, no. 1, pp. 51-59.

The author discusses muscle-shortening procedures, particularly tucking procedures, and describes his use of the "myocampter" and clamp. He advocates complete tenotomy guarded by suture which is adjusted postoperatively according to the state of the correction. He advocates hypocorrection for convergent strabismus with amblyopia,

and hypercorrection for divergent strabismus with amblyopia, the latter because of the natural tendency of an amblyopic eye to diverge. He has entirely abandoned the operation of advancement. Phillips Thygeson.

Kramer, M. E. The orthoptic treatment of the vertical motor anomalies. *Amer. Jour. Ophth.*, 1947, v. 30, Sept., pp. 1113-1123. (1 table, 1 figure, 16 references.)

Márquez, M. Physiologic explanation of the law of Hering in connection with double innervation of the internal rectus muscle of the eye. *Anales de la Soc. Mexicana de Oft.*, 1947, v. 5, Jan.-March, pp. 3-12.

With three excellent diagrams, the author restates, somewhat revised, his views with regard to conjugate and disjunctive movements of convergence and divergence. He postulates double innervation of the internal rectus muscle both for convergence in association with the internal rectus of the other eye and for adduction associated with the external rectus of the other eye. He confirms Hering's law of equal innervation for the two eyes for each class of movements. (References.)

W. H. Crisp.

Prangen, A. deH. Some observations on the surgical treatment of the extraocular muscles. *Amer. Jour. Ophth.*, 1947, v. 30, Sept., pp. 1161-1168. (16 references.)

Rigg, J. P. Operative technic for external and internal strabismus. *J. Internat. Coll. Surgeons*, 1947, v. 10, Jan.-Feb., pp. 63-71.

After a brief review of the principles of the physiology of binocular coordina-

tion and a description of some of the surgical procedures for the relief of strabismus, the author describes his own operation, the advanced tuck. By means of a suture passed through the tendon of a lateral rectus muscle 6 mm. behind its insertion, this part of the tendon can be advanced to the limbus and anchored there. The tendon has been folded on itself and an additional suture through the junction of muscle and tendon is placed for scleral anchorage. A Tucker or a Berens tendon forcepts is used in the folding of the tendon. F. H. Haessler.

Rose, A. T., and Pritzker, S. Paralysis of the abducens nerve following spinal anesthesia. *New England J. Med.*, 1947, v. 237, July 10, pp. 52.

A case of unilateral paralysis of the abducens nerve after spinal anesthesia is reported. Recovery was practically complete in three weeks. The onset of symptoms varies from three to 21 days and is usually preceded by headache, dizziness, stiff neck and photophobia. The paralysis is usually bilateral and is accompanied by diplopia. Recovery takes place in a few weeks or months and is usually complete.

F. H. Haessler.

Savitsky, N., and Winkelman, N. W. Cogwheel phenomenon of the eyes; its clinical significance. *Arch. Neurol. and Psychiat.*, 1947, v. 57, March, pp. 362-368.

The authors state that the occurrence of the cogwheel phenomenon during pursuit movements of the eyes is abnormal, and that its presence indicates the existence of organic disease of the brain. It has been seen most strikingly with chronic encephalitis and other organic diseases.

The authors have observed the cog-wheel phenomenon of the eyes with diphenylhydantoin and bromide poisoning.

The phenomenon has proved of diagnostic value especially in atypical cases of chronic encephalitis and in cases of head injuries. Theodore M. Shapiro.

Sheppard, E. W. Discussion of Miss Kramer's paper. *Amer. Jour. Ophth.*, 1947, v. 30, Sept., pp. 1124-1127. (3 figures.)

Soria. Marcus Gunn phenomenon and voluntary nystagmus. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, April, pp. 325-334.

Soria reports the case of a 26-year-old man with a left-sided partial ptosis, a Marcus-Gunn phenomenon, and voluntary nystagmus. The nystagmus was horizontal, rapid, of moderate amplitude, and not exceeding forty seconds in duration; the patient initiated it by looking down. The literature on both of these rare phenomena is reviewed. Of the various theories proposed to explain the Marcus-Gunn syndrome, Soria accepts that of Marquez, who believes that the phenomenon represents an exaggerated form of normal synerism between the movements of the mouth and the lids. He sides with Weekers in attributing the genesis of voluntary nystagmus to a cortical excitation, rather than to a cortical inhibition, as is believed by Wilbrand. (5 illustrations.) Ray K. Daily.

Swan, K. C. Esotropia following occlusion. *Arch. of Ophth.*, 1947, v. 37, April, pp. 444-451.

Four cases of esotropia that developed during periods of monocular occlusion are reported. It seems that

spontaneous recovery of single binocular vision is not to be expected from this uncommon, but serious, complication of a commonly used procedure. Treatment should be immediate; otherwise, the deviation tends to increase and the amplitude of fusional movements to decrease, and suppression is likely to develop.

A latent convergent tendency seems to be the condition underlying development of esotropia from occlusion; therefore, in the presence of esophoria or uncorrected hyperopia prolonged monocular occlusion for diagnostic or therapeutic purposes should be used with caution. In the reported four cases, a damage suit was instituted in three. In the treatment of unilateral amblyopia in patients with single binocular vision, lacquering the spectacle lens to reduce visual acuity in the better eye is suggested as safer than total occlusion because binocular vision is maintained. John C. Long.

Wolff, E., and Hefferman. A note on the position of the eye in a third nerve palsy. *Brit. Jour. Ophth.*, 1947, v. 31, July, pp. 427-428.

This very brief case report is presented to call attention to the fact that in oculomotor nerve paresis, the eye looks directly to the side because of overaction of the external rectus and not outward and downward. The superior oblique muscle is unable to depress the eye in extreme abduction.

Morris Kaplan.

5

CONJUNCTIVA

'Alagna, Gaspare, and Faraone, Giuseppe. Development of subconjunctival hemorrhages. *Riv. di Oftalm.*, 1946, v. 1, Nov.-Dec., pp. 657-670.

Extravasations of blood in the skin show color changes different from those observed on subconjunctival hemorrhages; 23 patients were studied to explain this difference. Five of them had hemorrhage with trauma, in six the cause was unknown, and in 12 the hemorrhage was experimentally induced by subconjunctival injection of one to two blood droplets of the patients own blood drawn immediately before the experiment. In this latter group, the blood deposit appeared dark red in the center, and pink in its periphery where biomicroscopy revealed irregularly distributed red cell groups. Twenty-four hours later, the diameter of the blood deposit was greater than after the injection, and biomicroscopically fine absorption lines become visible, forming a network of subepithelial radial channels, the conjunctival lymph vessels. After two and three days, the blood patch was still somewhat larger, pink in color and its borders hazy. At that time, yellowish lines were visible along the vessels, particularly the veins, easier to see at the periphery of the blood deposit. Later on, the color of the blood differs according to the location of the deposit. If it is situated in the exposed area of the bulbar conjunctiva, it changes from pink to yellow and in or near the fornix the color turns from pink to greenish. On the third and fourth day, the blood cells show changes in shape when examined with the corneal microscope and finally only granules of a yellowish red color remain. After 20 and more days, brownish granules are found near the vessel walls. In the two other groups, of traumatic and spontaneous hemorrhages, similar observations were made. The traumatic hemorrhages seemed to spread more rapidly, tortuosities and

partial interruptions of vessels were seen, aneurysmatic dilatations were found in some capillaries, and a granulated current with occasional "emptying" of the capillaries was observed.

The injection of blood under the conjunctiva of each eye of two dogs followed by closure of the lids of one eye failed to demonstrate that the difference in color is due to exposure. Finally, in two rabbits and in two dogs the lacrimal glands of one orbit were extirpated before the injection of blood. The blood patch looked pink as in human conjunctival hemorrhage only if the lacrimal gland was preserved; in eyes deprived of lacrimal irrigation, the blood patch turned bluish red on the third or fourth day, yellowish green two days later, and disappeared after the ninth day. The authors conclude that the bright red color of subconjunctival hemorrhage results from the formation of oxyhemoglobin; lacrimal fluid is needed to transfer oxygen to the blood deposit and to provide the temperature and hydroxyl-ion concentration essential for the oxygenation.

K. W. Ascher.

Bonazzi, A. Giant conjunctival granuloma from vegetable foreign body. *Rassegna Ital. d'Ottal.*, 1947, v. 16, March-April, pp. 131-136.

The very large granuloma described was observed in a farmer whose left eye was injured at the age of a few months and had been atrophic since then. It was assumed that a vegetable foreign body, plus the irritation of the prosthesis, had excited the formation of the granuloma which was adherent at three points. The histologic sections showed nothing unusual. (3 figures.) Eugene M. Blake.

Goldsmith, J. New modification of the McReynolds transplantation for pterygium. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 194-198.

In the McReynolds operation, the sutures are passed blindly through the loose subconjunctival tissue to emerge from the conjunctiva. The looseness of the subconjunctival tissue does not predispose to firm adhesions with the head of the pterygium. When the silk sutures are removed on the third to the fifth day after operation, part of the newly-formed adhesion is usually disturbed and broken; and if the retractive pull of the pterygium is sufficiently powerful, it is not long before the neck and the head of the retracted pterygium align themselves in the horizontal meridian to commence invasion of the cornea again.

In the new modification, the pterygium is carefully dissected from the cornea and an incision made along the lower margin of the growth. A narrow tunnel is undermined in the bulbar conjunctiva below. An incision 5 mm. in length, concentric with the limbal curvature, is made into the bulbar conjunctiva and Tenon's capsule and is placed 5 mm. from the limbus and made to connect with the tunnel. The head of the pterygium is brought through the tunnel into the new incision and there under direct observation sutured to the episclera and Tenon's capsule with a 0000 chromic gut mattress suture. The chances of recurrence are reduced to a minimum. It is advisable to employ a traction suture if excessive tension on the head of the pterygium is anticipated.

John C. Long.

Gutmann, M. J. Allergic warm season conjunctivitis. *Acta Med. Orientalia*, 1947, v. 6, May, pp. 167-169.

The symptoms of allergic conjunctivitis began to disappear 10 to 30 minutes after the intramuscular injection of 5 mg. riboflavin sodiumtetraborate and the patients were comfortable for 12 to 48 hours. Oral administration did not have the same effect.

Irwin E. Gaynon.

Lombardo, M. Recession of limbal conjunctiva. *Amer. Jour. Ophth.*, 1947, v. 30, Sept., pp. 1109-1113. (4 figures, 1 table, references.)

Marin Amat, M., and Marin Enciso, M. A profuse postoperative hemorrhage following a pterygium operation. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, April, pp. 389-391.

The authors report a postoperative hemorrhage after a pterygium operation, which assumed such proportions that it almost led to exsanguination; in spite of a compressive bandage, the use of all types of coagulants, and blood transfusion. The patient, a fifty-three-year-old woman, had had bilateral extirpation of the lacrimal sacs without complications three months previously. The pterygium operation with excision of the head was bilateral, and on the right side there was more than the usual bleeding during the operation. On the fourth postoperative day the right eye began to bleed after the bandage had been removed and the hemorrhage was checked by a compressive bandage. The bandage was removed the next day, and the following night the hemorrhage recurred, and continued for 24 hours in spite of all measures to arrest it. Hematologic studies revealed no basis for the bleeding. The authors attribute it to a K hypovitaminosis which resulted from chronic undernutrition.

Ray K. Daily.

Peyret, J. A. Vernal conjunctivitis: giant limbal type. *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Oct.-Nov., p. 309.

The author reports a case of vernal conjunctivitis with unusually large limbal lesions. The diagnosis was confirmed by biopsy. Several methods of treatment were tried unsuccessfully. Finally radiotherapy improved the condition markedly, the improvement persisting throughout a period of observation of nearly five years.

Plinio Montalván.

Radnót, M. A New oculo-glandular disease. *Ophthalmologica*, 1947, v. 113, Feb., pp. 106-108.

Four cases of a conjunctival lesion are reported that occurred in patients who had contact with probably diseased poultry 24 hours before the onset of the symptoms. No bacteriological studies were made. The disease is probably caused by a virus. It occurred during an epidemic of "birds' plague" in Budapest (apparently an acute infectious disease of fowl similar to chicken cholera) and was characterized by swelling and hyperemia of the conjunctiva without secretion or corneal involvement, followed 24 hours later by the development of a painful preauricular lymphadenitis. Complete recovery occurred within a week.

Peter C. Kronfeld.

Zewi, M. Reiter's disease. *Acta Ophth.*, 1947, v. 25, pt. 1, pp. 47-60.

Ten cases of Reiter's disease in patients treated at the Ophthalmic Clinic of the University of Turku are added to the literature. Whereas those formerly reported all occurred in adult men, six of the patients in this series were women. Two were 15 to 16 years old,

and the others over 20. Seven of the patients presented the characteristic triad of polyarthritis, conjunctivitis, and urinary symptoms, and three had no urinary symptoms, which usually are slight and transient. All patients had arthritis, which healed completely. All patients had a catarrhal conjunctivitis which was the first ocular disturbance. Zewi finds that this conjunctivitis has distinguishing features not recorded heretofore, which are of diagnostic importance. The injection is deeper than in an ordinary conjunctivitis, and one has the impression that an episcleritis covers the visible area of the globe. Ten patients had in addition a superficial keratitis, one a mild optic neuritis, and one a keratitis, iritis, and optic neuritis. All recovered completely. Nine of the patients had had diarrhea before being taken ill. This has been reported before and there appears to be some relation between this disease and intestinal infection.

Louis Daily, Jr.

6

CORNEA AND SCLERA

Agnello, Francesco. Herpes virus in the etiology of posttraumatic disciform keratitis. *Riv. di Oftalm.*, 1946, v. 1, Nov.-Dec., pp. 698-705.

Three cases of a posttraumatic deep corneal lesion are described. The lesion started three to four days after the injury, was unilateral and was associated with decreased sensitivity of the cornea and a tendency to recurrence. These qualities are characteristic of herpes. The injury was considered the precipitating etiologic factor and the basis of medicolegal action. K. W. Ascher.

Allen, J. A. Antitoxin treatment of staphylococcic corneal ulceration.

Amer. Jour. Ophth., 1947, v. 30, August, pp. 987-992. (4 figures, 3 tables, 2 references.)

Arjona, J. Giant leproma of the sclerocorneal limbus. Arch. de la Soc. Oft. Hisp.-Amer., 1946, v. 6, May, pp. 491-494.

A female patient, 36 years of age, had a tumor mass of six months duration on the left sclerocorneal limbus. It was a leproma and many Hansen's bacilli were found. The patient also had lepromas in the ears and on the hands.

J. Wesley McKinney.

Bedell, A. J. Cephalosporium keratitis. Amer. Jour. Ophth., 1947, v. 30, August, pp. 997-1000. (5 figures, 20 references.)

Burki, Ernst. Progress in keratoplasty. Schweiz. Med. Wchnschr., 1947, v. 77, May 10, pp. 525-528.

This lecture gives the history of keratoplasty, its indications, present status and various techniques of applying it. Early attempts (1818) at transplanting animal corneas failed. v. Hippel, by introducing the round trephine was able to perfect the operation on man but as he too used animal tissue, he was not successful in obtaining clear transplants. Since 1906, when human tissue was first used, keratoplasty has grown constantly easier and more successful.

Methods of corneal transplants are divided into total and partial. So far total keratoplasty, desirable as it is, has not been successful. Partial keratoplasty is of two kinds, partial lamellar (superficial) and partial full thickness, of which the latter is the one in general use. The source of the transplant may be auto-, homo-, or heterogenous. The latter is no longer used. Autoplastic

keratoplasty is the ideal procedure. A disc 6 to 8 mm. in diameter is cut out of a cornea with clear periphery and rotated so that the clear portion lies centrally. Healing leaves the cornea clear, but complications may result from the trepanation. Friede has recently suggested the use of a rectangular flap 3 to 4 by 8 mm. This reduces complications and will probably become the operation of choice.

Most ophthalmic surgeons prefer partial full-thickness homoplasty. A round flap, 3 to 5 mm. in diameter is preferred. Results are best after parenchymatous keratitis, injuries, and hereditary degenerations, poorest when there is anterior synechia or symblepheron or scarring from abscess or acid burns. Eyes with increased intraocular pressure are completely unsuited. The degree of injury is more important than the kind. Scars with anterior chamber intact are successfully replaced in 70 percent of cases, scars with anterior synechia in 20 percent. In complete leucoma the operation always fails. The degree of remaining visual acuity and age of patient are not decisive factors. Young children are less benefited than older individuals.

In homoplasty the donor material may be living cornea, surviving cornea, or killed cornea. The first can be available only in a very large clinic. The surviving cornea taken from patients recently dead of general disease is the material of choice. Eyes of older individuals are more suitable than those of the very young. The entire eye may be removed or pieces of cornea may be taken by trepanation. The material should be kept in a moist chamber at 4 to 6 degrees and may be thus stored for 10 to 12 hours. Transplants will remain clear for weeks if put into liquid paraffin, whereas salt solution

and other media quickly cause swelling and clouding. Tissue fixed in formalin will heal in, but always becomes cloudy later. Clouding is apt to occur eventually in many cases, and not until after eight months can one be certain that a transplant will remain clear. The factors causing late clouding are still unknown. Some believe the transplanted tissue remains and adapts itself as foreign tissue, others think the transplant is gradually replaced by the tissue of the host. Tissue regeneration unquestionably takes place since death and replacement of cells takes place constantly in all tissues.

B. T. Haessler.

Davidson, Alan. Primary lipid dystrophy of the cornea. *Arch. of Ophth.*, 1947, v. 37, April, pp. 433-443.

A case of primary lipid dystrophy with hypercholesteremia in a 61-year-old negro is presented. The patient has been followed for 21 months, and the lesion in the left eye has progressed steadily and asymptotically without evidence of inflammation.

A corneal transplantation was done on this eye, and pathologic studies of the transplant and of biopsy specimens of the cornea of both eyes revealed marked deposition of fatty globules in both corneas. Doubly refractile cholesterol crystals were seen in the epithelium of the left eye. The clinical characteristics of this condition are discussed.

John C. Long.

Fox, Sidney A. Removal of deeply embedded foreign bodies from the cornea. *Arch. of Ophth.*, 1947, v. 37, Feb., pp. 189-193.

Deep corneal foreign bodies may be removed by means of a corneal flap made with a Ziegler discission knife. The flap is fashioned by means of two

incisions meeting at an apex pointing toward the center of the cornea and containing the foreign body between them. The incisions are beveled toward each other, so as to approach the foreign body more closely. After sufficient depth has been attained, the corneal flap is folded back on its base and the foreign body exposed and removed. Rust stains may be curetted. The corneal flap is patted back in place with a spatula. Six illustrative cases are described.

John C. Long.

Franceschetti, S., and Babel, J. Histologic examination of a transparent corneal implant. *Ann. d'Ocul.*, 1947, v. 180, March, pp. 142-146.

Exactly how transparent corneal implants remain viable is not understood. One half of an eye containing a corneal graft which had been transparent during six years was imbedded in paraffin and sectioned longitudinally; the other half was stained with silver and cut frontally for better study of the corneal nerves. Sections showed that Bowman's membrane was present in the implant but not in the host. Descemet's membrane was present both in the host and the implant but was interrupted at their junction. No new vessels were observed in the implant and the stromal layers were continuous with those of the host. Numerous nerves which branched dichotomously were observed in the recipient cornea. Some of the nerves on passing toward the implant made a loop at its border and then entered the recipient cornea parallel to the implant margin. The nerves in the graft were subepithelial.

The primitive structure of the transplant was preserved. Cellular elements pass from the host into the graft. Nerve innervation is apparently secondary to vascularization. Nerve filaments in the

epithelium possibly have a trophic action essential to the physico-chemical exchange which is necessary in maintaining corneal transparency. (7 figures, 7 references.) Chas. A. Bahn.

Katzin, H. M. The preservation of corneal tissue by freezing and dehydration. *Amer. Jour. Ophth.*, 1947, v. 30, Sept., pp. 1128-1134. (1 table, 23 references.)

Krawicz, T. The reticulo-endothelial system of the cornea. *Brit. Jour. Ophth.*, 1947, v. 31, July, pp. 421-423.

To investigate the colloidoptic properties of corneal cells, that is, their permeability to colloidal substances, various dyes were dropped into the conjunctival sac of 30 rabbits for 50 days.

Ten rabbits were similarly treated with solutions of colloidal silver. In microscopic sections the dyes were found in all layers of the cornea which simply acted as a semipermeable membrane between the dye and the anterior chamber. The silver deposits were found intracellularly within the stromal cells and more abundantly within the structure of Descemet's membrane. The author concludes that the corneal stroma cells are wandering cells in a state of rest which means that they correspond to prohistiocytes and that they do not differ functionally from the fundamental components of the reticulo-endothelial system.

Morris Kaplan.

Langer, Z. M. Therapeutic keratoplasty in purulent keratitis. *Oftal. Jour. (Odessa)*, 1946, pt. 3, pp. 34-36.

This is a report of 12 apparently hopelessly lost eyes with extensive traumatic purulent keratitis, with visual acuity ranging from faulty light projection to hand movements, treated by keratoplasty. In two fresh cornea

was used for transplantation, and both eyes were lost. In ten eyes preserved cornea was used, and the final results were form vision in three, hand movements in one, and light perception in six. Regression of the inflammatory phenomena was apparent in two to three days after the operation. The postoperative course was complicated in 9 eyes by anterior synechia and secondary glaucoma. A prophylactic iridectomy, performed while the eye was acutely inflamed, was always beneficial. The curative effect of the transplant is believed to be due to its content of biogenic stimulators. The resulting corneal leucoma can be dealt with later by an optical keratoplasty.

Ray K. Daily.

Manschot, W. A. Blood staining of the cornea. *Ophthalmologica*, 1947, v. 113, April, pp. 203-214.

Four eyes with blood staining of the cornea became available for histologic examination. In one eye the staining occurred as a result of an obstruction of the central retinal vein with secondary glaucoma; in the other three eyes the staining developed after severe trauma. In two of the eyes the staining had been present only for a few days, in the other two eyes for several months. In the histologic picture different stages of the process can be distinguished. The first stage is characterized by the presence of the blood as an amorphous mass between the lamellae. After a few days this amorphous mass takes on a granular form, and then, apparently as the result of absorption from these interlamellar granules, the well-known highly refractile bodies of blood staining develop within the lamellae (second stage). This form of blood staining can last very long. The opaque disc in the

center of the cornea becomes smaller as time goes on, but a small central opacity is the usual permanent result of blood staining. The author has studied histologically the pigment particles that remain within the corneal corpuscles and found them to contain iron as well as fat (hemosiderin as well as lipofuscin). In a fifth (injured) eye the author was able to determine the chemical nature of the highly refractile bodies. After fixation in saturated mercury bichloride, he subjected the sections to tryptic digestion at 37° centigrade. Within seven days the refractile bodies disappeared from the sections which proves that they consist of proteins, apparently the crystalline form of the protein part of the hemoglobin molecule. Peter C. Kronfeld.

Nataf, R., and Fontan, P. Hereditary familial megalocornea. *Ann. d'Ocul.*, 1947, v. 180, May, pp. 267-272.

In a 20 year old male, both corneas were 14 to 16 mm. in diameter, globular and transparent and associated with iridodonesis. Vision could be corrected to 7/10 in each eye. The fields and color vision were normal. Embryotoxon was observed in each eye and in the right there was opacification of the lens nucleus, slight coloboma of the lens above, and partial absence of the zonula. The anterior chamber angle was free but distended. In both eyes the tension was 25 mm. Hg. No apparent endocrine disturbance existed, and the blood Wassermann reaction and chemical test of the blood were negative. Megalocornea existed in the maternal grandfather and in one brother. Chas. A. Bahn.

Pascheff, C. Further research on pannus follicularis trachomatosis. *Amer. Jour. Ophth.*, 1947, v. 30, August, pp. 1001-1004. (4 figures, 8 references.)

Peyret, J. A. Familial corneal dystrophies. *Arch. de Oft. de Buenos Aires*, 1946, v. 21, Aug., p. 205.

Two cases of Groenow's corneal dystrophy in mother and son are reported. In the first, a nuclear cataract was extracted from the right eye without complications. The vision improved to 1/10 with correction.

The literature on the subject is briefly reviewed. (Illustrations, bibliography.) Plinio Montalván.

Sagher, F., and Miterstein, B. Effect of Grenz rays on leprosy infiltrates. *Arch. of Ophth.*, 1947, v. 38, July, pp. 78-88.

Grenz rays were applied to lepromatous changes in the anterior segments of the eyeball in six patients. Since it was obvious, on the basis of experience with irradiation of the skin, that only large doses would be able to produce an effect, three practically sightless eyes were chosen for exposure to these rays. In all three patients the lepromas undoubtedly became reduced in size or disappeared completely.

When the Grenz rays were employed on the eyes of three additional patients which presented lepromas with fairly good vision, two eyes exhibited a favorable response, whereas in the third the lepromatous part which was irradiated became quiescent, or even slightly flatter, but the surrounding parts presented rapid growth of new lepromas.

The voltage of the rays used ranged from 6 to 14 kilovolts, which is equivalent to half value layers of 0.021 to 0.031 mm. of aluminum. The most effective doses applied at one sitting were from 700 to 1,200 r, and the total amount varied from 5,500 to 11,600 r. These large doses could be applied safely to the external tissues of the eye because the sensitivity of such tis-

sues to rays is lower than that of the skin. No damage to the cornea, lens or deeper structures of the eye was noted, so far as this could be determined on the basis of observations extending over a period of two to four years.

R. W. Danielson.

Schmidtke, R. L. Hypovitaminosis A in ophthalmology. *Arch. of Ophth.*, 1947, v. 37, May, pp. 653-667. (See Section 17; Systemic disease and parasites.)

Shepard, E. M. Relief of episcleritis by histamine diphosphate. *Amer. Jour. Ophth.*, 1947, v. 30, July, pp. 907-909.

Sjønøft, Finn. A case of interstitial keratitis after a gluteal abscess. *Acta Ophth.*, 1947, v. 25, pt. 1, pp. 73-80.

The gluteal abscess developed as a result of a milk injection given for a slight bilateral iridocyclitis, and cultures of the abscess showed hemolytic streptococci. Thirteen days after the milk injection a bilateral symmetrical corneal affection developed, which began near the limbus above, and gradually spread toward the center, with disseminated grayish interstitial foci. Myocarditis and pulmonary abscess developed on the day following the onset of the keratitis. In the course of 54 days, during which several fresh corneal foci appeared, the infiltrates disappeared, becoming hazier and receding towards the limbus. The patient was dismissed with residual posterior synechia, and small deep peripheral corneal opacities with deep vascularization. It was thought that the patient had a metastatic parenchymatous keratitis, secondary to a sepsis caused by the streptococcus. Where the streptococci originated remained undertermined. It

is not believed that it originated in the milk, because another patient, who was injected with 10 cc. of the same portion of milk suffered no complications.

Louis Daily, Jr.

Stanbury, F. C., and Wadsworth, J. A. C. Surgical technique of corneal transplantation in rabbits. *Amer. Jour. Ophth.*, 1947, v. 30, August, pp. 968-978. (6 figures, 19 references.)

Valdecasas, Pedro G. Keratitis caused by an alcoholic solution of chirimoya seeds. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1947, v. 7, April, pp. 379-380.

Valdecasas believes that the cases of keratitis reported by Romero as caused by alcohol fumes from a shampoo, are actually due to the caustic effect of chirimoya seeds, commonly steeped in alcohol, and believed to be effective against head lice. At present alcohol is commonly used as a constituent of face lotions and colognes, and it seems improbable that it alone could produce as pronounced corneal damages as was found in Romero's cases. It is more probable that the offending agent was the macerated seeds; the greater involvement of the center of the cornea is attributed to the lesser humidity in that area, which diminishes its capacity to neutralize the caustic effect of the alcoholic solution of these seeds.

Ray K. Daily.

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Arentsen, Juan. A case of sympathetic ophthalmia cured with penicillin. *Arch. Chilenos de Oft.*, 1946, v. 2, July-Oct., pp. 249-255.

The author has devoted attention to subconjunctival treatment with peni-

cillin, and arrives at the conclusion that the doses employed were in many cases too low. When the dose was carried above 1,000 or 1,500 Oxford units, the injections became very painful, so preliminary injection of 2-percent novocaine solution subconjunctivally was resorted to, and in this way it was possible to raise the dose of penicillin to 5,000 units. The author regards the best combination for subconjunctival injection as one part of 4-percent novocaine solution with two parts of physiologic sal solution that contains 5,000 Oxford units of penicillin per cubic centimeter. He reports the favorable outcome of such treatment in a sympathizing eye in which the involvement persisted for some time after removal of the exciting eye.

W. H. Crisp.

Barahona, B. Ectropion of the uvea. *Arch. de la Soc. Oft. Hisp.-Amer.*, 1946, v. 6, May, pp. 494-496.

A case of congenital ectropion of the uvea in a girl five years old is reported. The ectropion covered a large part of the iris stroma. The eye showed no other anatomic or function anomaly.

J. Wesley McKinney.

Carusi, E. A new procedure for the treatment of iridodialysis. *Rassegna Ital. d'Ottal.*, 1947, v. 16, March-April, pp. 93-97.

The procedure described consists of four steps. The conjunctival flap is dissected at the site of the iridodialysis; a keratome is introduced one half millimeter from the limbus to make an incision slightly less than the width of the dialysis; the iris is caught on a Jaeger hook and drawn out of the wound for one millimeter. The iris is then transfixed with a double-armed suture of hair by passing the needles through the conjunctival flap and tying

the knot. The iris is gently replaced so that the pupil is as nearly round as possible. Finally, the conjunctival flap is sutured with interrupted silk sutures.

Eugene M. Blake.

Dragomiretzki, G. A. Therapy of myopic chorioretinitis with vitreous from preserved eyes. *Oftal. Jour. (Odessa)*, 1946, pt. 3, pp. 32-33.

Dragomiretzki experimented with rectal and subcutaneous injections of autoclaved vitreous of preserved beef eyes. The course of therapy consisted of 10 injections, every other day. The tabulated data of 12 cases show an improvement in visual acuity, and in five patients a 10 to 15-degree widening of the visual fields.

Ray K. Daily.

Gormaz, Alberto. Sympathetic ophthalmia. *Arch. Chilenos de Oft.*, 1946, v. 2, July-Oct., pp. 255-256.

The author reports a case in which sympathetic involvement of the second eye began 56 days after enucleation of the exciting eye. Recovery occurred under sulfathiazole.

W. H. Crisp.

Kholina, A. A. Tissue therapy with the Filatov method. *Oftal. Jour. (Odessa)*, 1946, pt. 3, pp. 29-31.

Kholina reports from Kiev nine cases of severe iritis, which recovered more rapidly than usual, under treatment with injections of extract of leaves of aloes, and implantation of preserved skin.

Ray K. Daily.

Matteucci, P. Sympathetic innervation and the neuro-vegetative regulation of the uvea. (Influence of the cervical sympathetic upon intraocular tension in normal and pathological eyes.) *Rassegna Ital. d'Ottal.*, 1947, v. 16, May-June, pp. 186-198.

The conclusions reached by the author are derived from experiments upon rabbits and from histologic studies of the eyes which were enucleated after the experiments. Interference with the sympathetic nerves provokes oscillations of ocular tenion without modifying the caliber of the choroidal vessels. It also disrupts the physico-dynamic circulatory equilibrium of the blood and aqueous, so that there is altered capillary permeability and retarded reformation of the aqueous after puncture of the anterior chamber. Pigmentary changes were observed in the iris and ciliary processes. (9 photomicrographs.)

Eugene M. Blake.

Morano, M. Detachment of choroid in the course of hypertensive toxemia of pregnancy. *Boll. d'Ocul.*, 1946, v. 25, July-Sept., pp. 379-401.

Systematic observations of the fundus during eclampsia or the pre-eclampsia state, four cases of which are described in detail, lead the writer to believe that the so-called retinal detachment of eclampsia is in reality a detachment of the choroid. The sudden bilateral appearance of dark-gray non-fluctuating protrusions of the retina, always in the lower portion, the lack of retinal tears, and the disappearance of the protrusions after the emptying of the uterus are considered typical differential symptoms. Especially important for the differential diagnosis is the presence of pigment changes at the site of the detachments and the choroidal atrophy as is seen in choroidal detachment after intraocular operations such as cataract extractions and decompressive procedures. The pathogenesis of similar detachments is discussed at length. (Bibliography.)

Melchior Lombardo.

Nyquist, B. Benign course of sympathetic ophthalmia. *Acta. Ophth.*, 1947, v. 25, pt. 1, pp. 9-17.

Four cases of transient sympathetic ophthalmia, designated as such by Meller in 1925, are briefly reported. Three cases followed perforating sclero-corneal injuries, and one a cataract extraction. Two of the eyes were perforated by metallic splinters which entered the eyeball, and were extracted with a magnet, and one cornea was perforated by a piece of wood. All of the sympathizing eyes were free from subjective symptoms and had no ciliary congestion. The diagnosis was based on the presence of a few circulating corpuscles in the aqueous, and one or several small deposits on the posterior corneal surface, found on routine slit-lamp examination. Treatment during the pre-sympathetic stage consisted of atropin, pyrogenic agents, and rest. After the onset of sympathetic ophthalmia mercury ointment, neoarsphenamine, X-ray therapy, reduced illumination, and prolonged bed-rest were added. Of three enucleated eyes, histologic examination was available in two; the sections showed a chronic uveal inflammatory process, without typical nodules or giant cells. It is believed that intensive therapy arrested the development of the anatomic changes typical of sympathetic ophthalmia. The question of enucleating the injured eye after the appearance of sympathetic ophthalmia in the fellow eye is discussed, and contrary to the general belief Nyquist holds that such eyes should be enucleated because the inflammatory process in the injured eye may cause relapses of sympathetic ophthalmia in the fellow eye. (4 photomicrographs.)

Louis Daily, Jr.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATHS

Dr. William Lorne Deeton, Cleveland, Ohio, died July 28, 1947, aged 47 years.

Dr. James Garfield Dwyer, New York, New York, died August 2, 1947, aged 65 years.

Dr. Edwin Baker Goodall, Boston, Massachusetts, died August 6, 1947, aged 65 years.

Dr. John Jacob Gurtov, New York, New York, died July 28, 1947, aged 67 years.

Dr. Joseph Hallock Moore, Huntington, West Virginia, died August 3, 1947, aged 45 years.

Dr. Alpheus Keller Wilson, Jacksonville, Florida, died July 24, 1947, aged 67 years.

MISCELLANEOUS

During September and October, the Department of Ophthalmology, University of Glasgow, held a series of postgraduate lectures. The following papers were read and discussed: "Contact Lenses," Mr. F. Ridley; "Industrial Cataract," Dr. J. D. Fraser; "Pathology and Clinical Aspects of Ocular Glassmembranes," Prof. Arnold Loewenstein; "Some Problems in Ophthalmoscopic Diagnosis," Prof. A. J. Ballantyne; "Ophthalmology in Poland," Prof. W. J. B. Riddell.

SOCIETIES

PRELIMINARY PROGRAM

III PAN-AMERICAN CONGRESS

A tentative program for the III Pan-American Congress of Ophthalmology, at Havana, Cuba, has been announced by the committee.

Sunday—January 4, 1948

8:30 a.m.—Registration

3:00 p.m.—Preparatory Assembly—(business)

5:00 p.m.—Opening of Exposition—(scientific & commercial)

9:30 p.m.—Formal opening at Capitol

Monday—January 5, 1948

8:30 a.m.—Official opening of Scientific Program

12 to 2 p.m.—Lunch

2:00 p.m.—Official subjects of Scientific Program

9:00 p.m.—Formal session—University—(Honoring the Rector of the University of Havana, the Dean of Faculty of Medicine, and the Guest of Honor.)

Tuesday—January 6, 1948

8:30 a.m.—Official subjects of Scientific Program

12 to 2 p.m.—Lunch

2:00 p.m.—Courses—English, Portuguese, Spanish

4:30 p.m.—Exhibits

6:30 p.m.—Reception by the Mayor of Havana

9:30 p.m.—Cuban fiesta

Wednesday—January 7, 1948

8:30 a.m.—Official subjects of Scientific Program

12 to 2 p.m.—Lunch

2 to 4:30 p.m.—Courses—English, Portuguese, Spanish

7:00 p.m.—Reception by the Cuban Medical Federation

9:00 p.m.—Formal session Academy of Science—Gradle Lecture—Prevention of Blindness Medal to Dr. Harry S. Gradle—Award of Pan-American Medals

Thursday—January 8, 1948

8:30 a.m.—Official subjects of Scientific Program

12 to 2 p.m.—Lunch

2 to 4 p.m.—Courses—English, Portuguese, Spanish

4:00 p.m.—Free papers

9:30 p.m.—Pan-American fiesta at the Havana Yacht Club

Friday—January 9, 1948

8:30 a.m.—Official subjects of Scientific Program

12 to 2 p.m.—Lunch

3:00 p.m.—Business meeting

6:00 p.m.—Reception at the President's Palace

Saturday—January 10, 1948

8:30 a.m.—Prevention of Blindness

1:30 p.m.—Lunch at the Jockey Club

2:30 p.m.—Races

9:00 p.m.—President's banquet—(Closing)

ANNOUNCEMENT

BOARD EXAMINATIONS

The American Board of Ophthalmology announces that the written qualifying test will be given on January 14, 1948, in many cities throughout the country. Practical examinations will be given at Baltimore in May, and at Chicago in October. Information may be obtained from Dr. S. Judd Beach, secretary, 56 Ivie Road, Cape Cottage, Maine.

PAN-AMERICAN NOTES

Edited by M. Uribe Troncoso, M.D., 500 West End Avenue, New York

Communications should reach the editor by the 12th of the month.

III PAN-AMERICAN CONGRESS OF OPHTHALMOLOGY

The government of Cuba has extended official invitations to all the governments of America to send representatives to the III Pan-American Congress of Ophthalmology. It is expected that many ophthalmologists will be present, not only from this country, but also from South America and Europe. Sir Stewart Duke-Elder, London, Dr. Bailliant, Paris, Dr. A. Fuchs, China, Dr. Manuel Marquez formerly of Madrid and now of Mexico City, Dr. K. Lindner, Vienna, and Dr. H. Arruga, Barcelona, have promised to attend and read papers. Besides the official reports, 27 free papers have been included in the program. In a special session on January 7th an honor medal of the Pan-American Congress will be presented to Dr. William H. Crisp of Denver and Dr. Manuel Uribe Troncoso of New York.

The meeting of January 10th will be devoted to papers and discussions on prevention of blindness, in which Dr. F. M. Foote from the United States and other directors of similar societies in Latin America will be present. Dr. P. Bailliant, the president of the International Association for the Prevention of Blindness, has promised to attend the meeting.

Fifty courses of instruction given in English, Spanish, and Portuguese are included in the program and will take place on January 6th, 7th, and 8th. Besides the Scientific Exhibition there will be a Technical Exposition and an Exhibition of Ophthalmological Literature. A new departure is the collection of amateur art, curiosities, oil and water color paintings, photographs, sculptures, and other objects of similar nature made by ophthalmologists or their relatives.

The receptions and entertainments will be numerous. The President of the Cuban Republic will receive the members of the Congress in the Presidential Palace and the many social and medical clubs of Havana will be open to all members and their families.

Although no more reservations are available at the principal hotels, the local committee, (Dr. Miguel Branly, Secretary Escuela de Medicina, Calle 25 e I, Vedado, Habana) is arranging to provide new accommodations for late applicants in the smaller hotels and in private houses. A

check or money order for ten dollars (\$10.00) should be sent to the secretary to secure reservations.

GUATEMALAN OPHTHALMOLOGICAL SOCIETY

On August of this year on the occasion of the visit of Dr. Tomas R. Yanes and Dr. M. A. Branly of Habana, the ophthalmologists of Guatemala met and started a society which will work for the advancement of ophthalmology in the country and encourage the education of young specialists. Dr. Branly offered a fellowship in ophthalmology for a student who will attend the courses in Habana University and its Hospital. On the board of the society are Dr. R. Pacheco Luna, president, and Dr. J. Miguel Mcdrano, secretary.

NECROLOGY

Dr. A. Garcia Miranda, professor of ophthalmology in Granada and then in Salamanca, Spain, one of the most progressive young Spanish ophthalmologists, died recently in Spain, after a professional trip to the United States.

CHILE

At a meeting held on April 5, 1946, the following officers were unanimously elected by the Sociedad Chilena de Oftalmologia: President, Prof. Italo Martini; vice president, Prof. C. Espildora Luque; treasurer, Dr. Rene Contardo; secretary, Dr. Adrian Araya; pro-secretary, Dr. Herman Brink.

ECUADOR

The Sociedad Ecuatoriana de Otorrinolaringologia y Oftalmologia (Quito) has elected the following officers: President, Dr. L. Fernando Lopes; vice president, Dr. Herman Parker; secretary, Dr. A. Carlos Peña; treasurer, Dr. P. Cevallos Jijon.

URUGUAY

The Sociedad Uruguay de Oftalmologia has elected the following officers to serve during 1946-47: President, Dr. Julio A. Sicardi; vice president, Dr. Luis A. Barriere; secretary, Dr. Guillermo Rivas; treasurer, Dr. Ignacio Errca.

AMERICAN JOURNAL OF OPHTHALMOLOGY

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